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Republic F-105 Thunderchief



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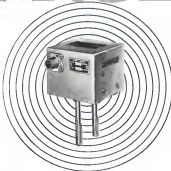
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would be
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AVIATION CALENDAR

- Aug. 8-10-11th Annual Aeronautical Meeting, Institute of Aeronautical Sciences, U. S. Coast Hotel, San Diego, Cal.
- Aug. 6-10-Helicopter Symposium in Europe Today and Tomorrow, J. Naim, Selsby Ridge, Acton, Herts, U.K.
- Aug. 10-11-12th Annual Meeting, Helicopter Society, Langley AFB Officers Club, Va.
- Aug. 10-11-Midget Airplane Race, Oak Lake, Wis.
- Aug. 11-Open house for pilots and public, Piper Aircraft Corp., Lake Haven, Va.
- Aug. 10-12-Boston Scientific Educational League Conference, Seelye, N. Y.
- Aug. 10-12-Western Electronic Show & Convention, Com. Palace, San Francisco, Calif.
- Aug. 10-12-Gas Dynamics Symposium, Transport Properties in Gases of High Temperature and Pressure, Technological Institute, Northwestern University, Evanston, Ill.
- Aug. 20-22-Panor Central Meeting, Space Institute of Aerob. Engineers, Paris, France.
- Aug. 31-Sept. 3-Midget Airplane Race, Ft. Worth, Tex.
- Sept. 1-15-16th International Aeronautical Conference, Royal Aeronautical Society and Institute of the Aeronautical Sciences, Falmouth and London, England.
- Sept. 1-15-1957 Theme Display, Society of British Aircraft Constructors, Farnborough, England.
- Sept. 5-14-15th General Assembly, Inter-agency Group of Cooling and Composites, in cooperation with National Geophysical Inst., University of Toronto, Canada.
- Sept. 7-Second Annual Convention of the ONS Club, Royal Philips, Kansas City, Mo.
- Sept. 8-15-Second Annual Course on the recent Cooling, Massachusetts Institute of Technology, Cambridge, Mass.
- Sept. 9-15-Annual General Meeting, Inter (Continued on page 6)

AVIATION WEEK • AUGUST 5, 1957

Vol. 47, No. 8

Aviation Week gives an additional look to the world of the aircraft industry. It is a time when the industry is open to the public and the press. It is a time when the industry is open to the public and the press. It is a time when the industry is open to the public and the press.

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Aviation Week, August 5, 1957

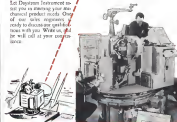


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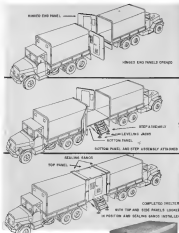
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AVIATION CALENDAR

(Continued from page 5)

- 3rd Audubon, Cleveland, Ohio
Sept. 13—Third Pacific Area National Meeting, American Society for Testing Materials, Sheraton Palace Hotel, San Francisco, Calif.
Sept. 15—1917 Gordon Ferry and Flying Trophy, Royal Aeronautical Society, Warley Aerodrome, Wimbore, England
Sept. 22-24—Fall Meeting, American Society of Mechanical Engineers, Sheraton Hotel, Hartford, Conn.
Sept. 26-27—65th Michigan Association Conference, jointly sponsored by University of Michigan Transportation Institute, Western Michigan University, and The Aero Club of Michigan, Alpena, Mich.
Sept. 28-29—North Central Regional Conference, Civil Air Patrol, Town House Hotel, Kansas City, Mo.
Sept. 30-Oct. 1—National Aeronautics Meeting, Aircraft Production Forum & Aircraft Engineering Display, Society of Automotive Engineers, Hotel Anderson, Los Angeles
Oct. 2-4—Fourth Annual Meeting and Forum, National Business Aircraft Assn., Commodore Hotel, Denver, Colo.
Oct. 7-9—10th Annual National Electronics Conference, Chicago, Ill.
Oct. 7-10—Transonic Symposium, Langley Research Laboratory, Cleveland
Oct. 7-12—Flight Annual Congress, International Aeronautical Federation, Sheraton Hotel, New York
Oct. 7-12—10th Annual Meeting of the American Society of Mechanical Engineers, Sheraton Hotel, New York
Oct. 9-11—National Fall Convention, Society for Experimental Stress Analysis, TI Center Hotel, San Diego, Calif.
Oct. 10-11—National Navy Afternoon Symposium, Sheraton Hotel, Chicago, Ill.
Oct. 12-13—Canadian Aeronautical Association Institute of the Aeronautical Sciences Meeting, Montreal, Canada
Oct. 14-15—Conference on new developments in the field of space, American Society of Mechanical Engineers, Sheraton Hotel, Sheraton Hotel, New York
Oct. 14-15—Fourteenth Annual Display, Aircraft Engineering, Aircraft Electrical Society, San Francisco, Calif.
Oct. 14-15—Second World Symposium, American Nuclear Society, Sheraton Hotel, New York
Oct. 15-16—Third Annual Meeting, Association of the U. S. Army, Sheraton Park Hotel, Washington, D. C.
Oct. 15-16—Annual East Coast Conference on Aeronautical and Astronautical Electronics, Fifth Regiment Armory, Baltimore, Md.
Oct. 15-16—National Industrial Packaging & Handling Exposition, Atlantic City, Convention Hall No. 1
Oct. 16—Aviation Electrical Equipment Display, 15 & 16th Street, San Diego
Nov. 1-3—Joint Military Industry Guided Missile Reliability Symposium (dedicated to those with Secret security clearance), Naval Air Station Test Center, Ft. Wainwright, Alaska
Nov. 3-4—Third Annual Symposium on Aeronautical Communications, Sheraton Hotel, New York
Nov. 18-19—International Air Transport Assn., Technical Conference, Miami, Fla.

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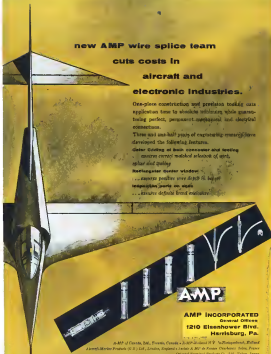
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insulation stripping on wires

• ensures definite bond interface



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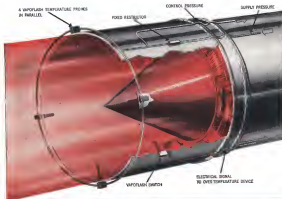


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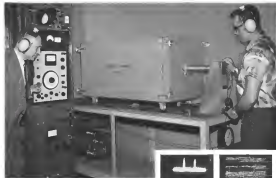
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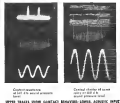
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the bird
that walks
on its
tail!



...with control components by **WESTERN GEAR**

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Write for Aviation Products Catalog, Bulletin 330

A Pattern Emerges

Some distinct outlines of the future military aerospace program resulting from the proposed fiscal juggling and organized confusion of the Fiscal 1958 Defense Appropriations Bill emerged last week in the red brick building here in Washington where the Air Force Association held its annual convention. An ongoing series of top USAF military and civilian brass plus two of the most influential Senators on defense matters—Leverett Saltonstall, Republican of Massachusetts and Stuart Symington, Democrat of Missouri, did a remarkably frank job of spelling out in as much detail as it is possible to glean from the current confusion just where we are heading in our military aerospace program.

The pattern they painted is not rosy. Even Sen. Saltonstall, who has been the Eisenhower Administration's staunchest supporter on defense policy in Capitol Hill, is "disappointed" with the aerospace aspects of the Fiscal 1958 Defense Appropriations Bill. Sen. Saltonstall also warned that any superiority over Soviet aerospace may now come only with but only for another 18 months and urged a "reappraisal" of our aerospace pattern in 1958.

Sen. Symington of course went further in his critique of current policy. He bluntly charged that defense policy was now being determined solely from the budgetary viewpoint, without any real regard for the strength of our military forces versus those of the Communist bloc. He further charged that the incredible fluctuations of the military aerospace program during the past year are wasting billions of dollars without achieving any degree of military strength. He cited data furnished him by the Pentagon showing that there had been 17 major budget changes in the Air Force program during the past year. The swivel dollar resulting from these constant changes would be simple to finance adequate aerospace, he said.

Sen. Symington told Symington the reason for the cancellation was that USAF was concentrating on the Douglas C-119, a smaller transport now flying in prototype stage. The Senator asked the Secretary how many C-119s USAF planned to purchase with Fiscal 1958 funds. The Secretary refused ignorance on this subject, confided with his aides and then informed Sen. Symington that no C-119s would be purchased in the Fiscal 1958 program. Asked Senator Symington, "What kind of concentration is that?"

Douglas Warns Industry

USAF Secretary James H. Douglas did his usual blurt, blurt job of explaining an irreparable situation as well as possible. "There are still many areas where no final decisions have been made," he told the convention. This means of course that industry will have to follow the meanderings of Pentagon policy extremely closely in the months ahead if it is not to be caught napping by major policy shifts. Secretary Douglas was more frank than any Defense Department official in discussing the programs that have been stretched or cut, and the timing thereof. He also warned that USAF must cut its Fiscal 1958 expenditure estimates by a billion dollars because of administrative imposed budget limitations.

He also warned that development programs are getting a thorough screening in USAF and the less promising avenues of development will certainly be abandoned during the next few months. A more realistic appraisal of modification programs on the basis of showing only for major technical improvements also is in progress. To get the picture in its proper perspective, Secretary Douglas emphasized that Fiscal 1957 which just ended had the highest peacetime expenditure in history (\$7.5 billion for hardware) and that Fiscal 1958 would have the second highest, with some \$7 billion for procurement of aircraft, ordnance and related equipment.

Gen. Edwin Rawlings, whose long tenure as Air Materiel Commander qualifies him as the best military manager in the business, offered many interesting blueprints for the transition period of the next decade, when global aircraft and missiles will exist side by side in the aerospace arsenal. Most significant perhaps was his warning that missiles will have to force their way into the USAF weapons inventory on the basis of performance superior to any other type of ordnance for a particular combat mission. There has been too much technical uniformity talk, about how missiles would supersede manned aircraft for virtually all missions in the near future. Spokesmen of the defense world did well to heed the realistic approach of Gen. Rawlings and Gen. G. C. S. Irvine, Deputy Chief of Staff for Materiel, who also spoke to the industry gathering.

This type of broad aviation industry USAF meeting is a valuable supplement to the sales pitch and bargaining sessions of individual firms doing their business in the Pentagon. The USAF industry relationship can thrive only in this atmosphere of free interchange of information that often both sides are opportunities to understand better the other's problems and goals. —Robert Hottel



2 cfm Compressor Package



4 cfm Compressor



6 and 8 cfm Compressors



4 cfm Portable Ground Service Cart

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[illegible]

James E. Cunningham, executive vice president, and **Harold M. Miles**, senior vice president, **Whelanator Corp.**, Milwaukee, Ind.

Daniel S. Lewis, Jr., a vice president, **McDonnell Aircraft Corp.**, St. Louis, Mo.

Robert F. Long, a vice president, **Aircraft Engineering & Maintenance Co.**, Oshkosh, Wis.

Frank Raffner, vice president-sales, **Micrometall Sales Associates**, Hollister, Calif.

Alvin Ernest F. Sackett, assistant to the president and acting chief engineer.

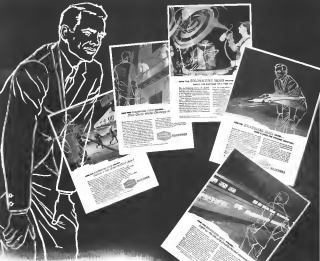
Sam Gaudin, Jr., vice president sales, **Olin Aluminum**, Olin-Matheson Chemical Corp., New York, N.Y.

Robert C. Coffy, manager of the Contract Division of Clay Corp., has received a citation from the American Oilsolvent Association in national recognition for his role in the country's defense and preparedness.

► Eastern companies are participating in Navy competition for new carrier-based attack bomber. Specifications call for more equipment, increased range and frequency. Design accepted probably will fill gap between AMD's gross weight of about 15,000 lb. and AD-9's 70,000 lb.

► Army is considering continuation of the Fairchild deflected wingman test bed project with on-board engines to replace the four piston engines in the original design. Design would be applied to Army's requirement for KIM, *Forrestal* wrote.

►Vertol Aircraft Corp. expects that its H-21D helicopter, powered by two General Electric T38 engines, will make its first flight next week. Vertol's winning test bid for the Army VTOL competition also is almost ready for first flight.



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Washington Roundup

Hebert Engine Investigation

Federal crews of bearings on the profits and precise recent prices of several engine manufacturers before the House Armed Services Investigating Subcommittee appear to hang nearly on how long the House session in session.

Subcommittee hearings were canceled "indefinitely" last week in Chairman Edward Hebert (D-La.) because the full Armed Services Committee was meeting. Pratt & Whitney Aircraft Division of United Aircraft Corp., Westinghouse Electric Corp., and General Electric Co. were scheduled to appear. The subcommittee has only held one examination so far: Century-Wright Corp. (AW July 29, p. 34).

Hebert (who's rule sets the possibility that the investigations might be dropped until next year).

The Senator From USAF?

Misstatement of the work was made by members Bostonian Sen. Everett Ruessell before the Air Force Association convention. Referring to Sen. Stuart Symington, who chaired the platform with him, he said: "And I am sure Mr. Symington will agree with me." Then he pointed and said, "I don't know who it is, but I think refer to him as Sen. 'Twining'." Gen. Nathan F. Twining, former USAF Chief of Staff and now Chairman of the Joint Chiefs, was not present.

Symington, senior Republican on the Armed Services Committee, was agreeing with Symington that the new Air Force budget is a disappointment. At the same time, he insisted that USAF is big and strong enough to meet its obligations at that time. He recommended that its strength be supported in a year or so and a half. Symington disagreed with both Symington and the AFA on their assertion that Korea is superior to the United States in the ballistic missile field.

Civil Aviation Bills

Delivered in Washington by the Senate's civil rights debate, Congress took action last week on several civil aviation measures.

Aerospace Modernization Board. Lt. Gen. Edward R. Quessell who replaced Edward P. Connel in special assistant to the President for aviation, is expected to be named shortly to head the new agency to develop an aviation navigation system (AW July 1, p. 38).

Legislation creating the five-member board, unanimously passed by the Senate, was overwhelmingly approved by the House last week 375 to 17. Other members would be the Secretary of Defense and the Secretary of Commerce (AW July 15, p. 29). A technical House amendment, however, the President's authority to transfer funds from other agencies to the new board, could concentrate a special appropriation.

Local service agencies. Legislation which would permit railroad carriers to set aside earnings from equipment sales for the purchase of new equipment, previously aimed at aiding local firms with their equipment programs, was approved by House Commerce Committee, but rejected last year in a similar. The measure was passed last year in the Senate and approved in the House committee, but was killed on the House floor.

After this measure passed in the House last year, it was approved by the House Judiciary

Committee. This gives leading transportation rights to equipment that have declined in case of bankruptcy.

New Washington Airport. A \$15 million appropriation for an alternate airport at Dulles, Va., to serve the capital again as it has for the past seven years—has no voting opposition at the National Legislature. This was the President's final request. In his argument, the President was correct: "The responsible executive agencies have concluded that the best available long-term solution is a new airport at the Dulles site."

Missile Information

USAF is making headway in its campaign to have more—and more accurate—information released on guided missile frings. USAF Secretary James H. Douglas has discussed the matter with Secretary of Defense Charles E. Wilson. USAF's Office of Information Services is expected to make a formal presentation to Wilson this week, showing that much officials "should" inform two on missile frings is publicly known.

A memo issued by Martin Snyder, Assistant Secretary of Defense for Public Affairs, now prohibits the disclosure of any details except confirmation of the fact that a test firing has occurred and "a brief statement" to an audience. In testimony before the House Government Information Subcommittee, Brig. Gen. Arno Luchman, director of USAF's Office of Information Services, noted that USAF is concerned that an erroneous impression (an misleading) is getting widespread and is getting somewhat the area of truth. We feel that the progress we have made in this missile development fring, has reached the point now that we ought to consider telling a little more about it" (AW July 11, p. 51).

In a letter to Snyder, Brig. Gen. J. P. Moss (D-Calif.), chairman of the House Government Information Subcommittee, emphasized that Snyder's assurance that he wants "to get out the news" and his missile fring means are not consistent.

Whatever knowledge of missile fring information that can be approved by Wilson will then have to be approved by the Operations Coordinating Board, headed by Under Secretary of State Christian A. Herter, and composed of representatives of the President, Defense Department, Central Intelligence Agency, and U.S. Information Agency.

Newbury Successor?

Paul D. Foster, 69, assistant research consultant and a former executive vice president of Gulf Research and Development Co., is being mentioned as a possible successor to Frank D. Newbury, former Assistant Secretary of Defense for Research and Engineering.

Foster was in the Pentagon as a consultant on materials for the National Academies of Sciences, but resigned almost six years ago as being used for a market survey. Since Newbury left the post after consulting work in attitude toward research and development (AW Apr. 28, p. 27), administration has been unable to find a suitable replacement.

Foster also held executive positions with Gulf Oil Corp. and Gulf Refining Co. before retiring in 1954 to become a consultant.

He now lives in Washington and does a considerable amount of work for the National Academy of Sciences.

—Washington staff

Employment Drops From 900,000 Peak

Aviation Week survey indicates spending slowdown to eliminate at least 40,000 jobs by year's end.

Job reductions among 22 major aviation firms will total 40,000 by the end of the year according to current planning, say American Works news editors.

Companies emphasized, however, that the employment situation is uncertain. Sales between now and the year's end will directly affect hiring policies at most firms. Expected further reductions in defense spending will demand jobs still further in some companies. Others say they will be hiring if hoped-for supplies are available.

Most firms hope to make use of or discontinue designs they already describe as "near term" or "interim," reducing efforts wherever possible.

Act's hardest hit is Southern California. Los Angeles manufacturers are the hardest, says the survey, with 10,000-approximately one-fourth of all aircraft and parts workers in the nation. Shortly before defense cutbacks began to be felt, this accounted for about 24% of manufacturing employment in the Los Angeles area, and almost 9% of total employment. San Diego area employers approximate another 15,000 aircraft and missile workers.

Production firms are facing the hardest cutbacks. Some firms are scaling back engineering staffs, but that in itself will be contained, being of other plants, particularly in missile work and capacity of highly skilled engineers.

Hiring Cutback

In addition to eliminating jobs, a number of companies have already closed hiring.

Reduction figures in this Aviation Week survey do not include the no action job reductions that will result among more subcontractors.

Point is, according to current planning, defense cutbacks will have averaged 880,000 workers in 1956 to become the nation's largest employer for a full 12 month period for the first time in history (AWD 31 p. 25).

Department of Labor's Bureau of Labor Statistics listed some 500,000 workers in the aircraft and parts industry in 1954 for 1956 of 400,000 in March of 1955.

The bureau's figures also show a further drop because to 300,000 in April, and then a decline for May to 300,000, but the May figure is preliminary. June and July's figures, which will reflect larger reductions, are not yet available.

Most aircraft companies listed

through the last half of 1955 and some have continued right up to the present but some companies reported they began to slow down hiring or to reduce staffs in late January.

Here is the employment outlook at some of the major aviation firms:

North American Aviation, Inc.

North American now expects a total reduction of 15,000 by the end of the year instead of the 15,000 announced just after cancellation of the Navaho missile contract (AWD July 22, p. 29). Prior to Navaho cancellation total employment was 69,197, with 46,497 of these in the Los Angeles area. Burtch, born in that area through Aug. 15, now are expected to total 7,100. Additional 5,700 reductions will be accomplished in the next four months, with 4,000 in the Los Angeles area. Burtch will be in the Los Angeles area, from the Missile Development and Activities division. Highest

reductions are in production, with engineering and technical areas next. Some lower civilian administrative jobs also are being cut.

Employment by divisions below the Navaho cancellation was: Los Angeles 23,000; Columbus, 15,700; Fort Worth, 2,414; Minneapolis Development 7,714; Mechanics at Corpus, 7,394; Rossmore, at Corpus, 16,154; Avionics International at Corpus, 14,180; general offices, 625.

Of North American's 587,142,211 backlog on June 10, approximately 512,000 backlog is represented by Navaho projects. Among divisions which ended out back figure has been lowered are continuing Navaho flight test activities, production work, continuing component development, flight of Navaho personnel to other projects, further reductions in continue in all divisions, retooling of more 7,900 work, an extension of current projects and general development of new equipment, and, except of a substantial for direct mail work from another Los Angeles aircraft manufacturer.

North American also is working on propulsion systems for Atlas, Thor, Jupiter and Redstone rockets, including IT-1, developing the Navy AT-1 and a USAF long range subsonic, chemical rocket, building the X-11 rocket engine and producing the Navy J-17 jet booster.

Douglas Aircraft Corp.

Douglas employs 75,718 and expects to reduce this to 50,000 by the end of the month. Attrition is expected to take care of attrition of all this. Most reductions will be in production. New airplanes will be administrative, engineering personnel will increase slightly, mostly in missile work. Electrical-electronics engineering ratings now has general shortage. Employment by divisions at Santa Monica including Caltech 4,246; plant, office, corporate in Southern California and general offices—36,412; El Segundo, including Tuzome plant, 27,174; Long Beach at Boeing, Irvine plant, 17,744; Tulsa, 8,714; Chula Vista, 1,000. Reduction cannot be shown by divisions because work is often shared between divisions especially in California.

Lockheed Aircraft Corp.

Lockheed employs 47,168. Reduction of 2,000 to 5,000 is anticipated either the act or to 12 months to be spread between the California and Georgia divisions, but employment in Missile Systems at Palmdale and Santa Ana probably will increase. Primary

reduction will be in production and administrative areas. Engineering is being increased in number, but emphasis is on increasing unskilled personnel in outside field. About half of the 2,000 5,000 reduction will be taken care of by turnover. Employment by divisions in California, 31,000; Georgia, 19,000; Missile Systems, 5,100.

Convair Div. of General Dynamics

Total Convair employment is 75,000. No salaries or wages, profits are expected. Slight decline may occur at San Diego, Ft. Worth, which has reduced work force in 1,000 in the past month, as jobs in further reduction of about 1,000 in year end. Convair's engineering having long been strong, it will not be months ago because requirements were greatly cut. Slight decline in engineering force may result from the total cut in job performance. May not see being might be announced, maintenance, electrical, electronic, rule and production engineering, but with some selectivity.

Production employment decline at San Diego will be gradual and much of it will be absorbed by normal turnover, a midsize large industries are that some military aircraft delivery will be deferred to the next calendar year, some 1956 deliveries will be stretched out 1959. Ft. Worth Division, which had a Kansas corporation and, employee total of 33,000 now employs 20,000. That is up from 24,000 a year ago but down below 27,000 a month ago. Cost of 1,000 in next five months will be taken care of by turnover, with some loss of some profits and some turnover. But, of just month's reduction was in production workers, but the next 1,000 will include administrative. Engineers are still being hired but at a slower rate.

Los Angeles' Stand

Los Angeles—President Charles E. Deussen of the Los Angeles Chapter of Commerce says the Chapter intends to see that the Southern California area is not discriminated against in the cutback of defense contracts.

Deussen said the Chapter also intends to see that the concept is not used to cause a move to disperse the industry from that area. The Chapter recognizes that some changes in types or products and methods of California companies are inevitable and a strong company to diversify. It hopes that the cutbacks are aimed at greater economy, sound business practices, modernized weapons.

The month's engineering and production losses have continued in the Southern California plants are vital to the Air Force and it is essential that they be effectively utilized for most efficient development of whatever air defense systems are here in the future. Deussen said.

Large production contract for the B-36 could mean some change in capacity next year. Employment by divisions other than Ft. Worth San Diego, 12,318; Mechanics, San Diego, 8,895; Personnel, 5,861; Douglasfield, Tex., 171, general offices, San Diego 310.

Northrop Aircraft Inc.

Northrop employs 72,571 and its subsidiaries Redstone Corp. 2,316. No substantial change is expected in the next year to 12 months, although engineering and technical staffs may drop up at Redstone. Being to meet turnover will continue. Employment by divisions: Burbank, 20,913, which includes 516 at Perkin, AFM, 1,423 at

Palmdale, 179 at Edwards AFB, 71 at Los Angeles Airport and 16 at Holloman. Airbus plant employs another 1,371.

Reeing Airplane Co.

Reeing employs more than 80,000. Work here in Seattle, Reeing says will have been reduced between 5,000 and 8,000 by the first of the year. Attrition is expected to take care of most of this. Hiring for the first year has been stopped except for some highly skilled and technical outgrowth.

Wichita Division employment will be reduced by 1,000 to 4,000 in the next six months. Boeing said "further possible reductions beyond the first of the year cannot be predicted at this time because of the variables involved."

Seattle Reeing reductions will result from completion of certain backlog projects, completion of advanced B-56C production in Wichita, "various scheduled adjustments brought about by changes in Air Force procurement policy," and the usual drop in work force which occurs when production is well under way, Boeing said.

Chance Vought Aircraft Inc.

Chance Vought's next fiscal year is 19,800 from 12,500 of a year ago, when the company was between production programs on the Canine and Graceland. USA Graceland and Republic II work in production and F100-3 in development work level is not expected to change appreciably. Most of the gain in the past year has been in production work, but some engineers also have been added.

Tuomey Aircraft Corp.

Tuomey employment is about 10,000 down slightly over the past few months.



X-14 Cost Cut by Component Purchase

Bell X-14 VTOL, test vehicle, shows how in design point, made up of wings, airframe and landing gear from Boeing's Boeing four place executive aircraft and components from the Rockwell X-14A military transport. Bell's four place executive, cooperation from Bell over 500 to the cost of the experimental X-14 (AWD July 8, p. 28). All of these components that will not be cancelled in any time for any future production. Bell and similar approach on the Bell VTOL, combining a Schweizer glider fuselage with a Cessna 170 wing. Two Armstrong-Hughes Viper ASV 8 engines power the X-14. Years later the exhaust ductwork the vertical flight.

USAF Leaders Emphasize Austerity

By Clark White

Washington—Supporters, pointing to new USAF procurement policies, feared be technological evolution and the budget pinch, were revealed in the aircraft industry last week at the 11th annual convention of the Air Force Association.

Among them were:

- **Strong** unanticipated increase in rate of expenditure, personnel, reduction alone may cause further stretch of aircraft procurement programs before fiscal 1978.

- **Scanning** of development projects will continue and more of them will be abandoned.

- **Research** and development policies face a major shakeup with USAF's turning to multiple sources when it feels that the resources of more than one company are needed to do the best possible job.

- **Contract** maintenance and overhaul expenditures will be reduced. In this case, no change in policy is contemplated, but USAF will award IRAN service for a "good many second line aircraft" while still maintaining its emphasis on its own overhaul depot.

- **Tougher** competition will take its toll from major prime contractors and subcontractors and vendors. But USAF will discourage primes from filing their own bids to meet contract production.

Panel of top level USAF leaders and civilian officials, headed by Air Force Secretary James H. Douglas and Vice Secretary Douglas H. Douglas, emphasized their serious sharing requirements at an address to the industry representatives. Separate presentations were given by USAF headquarters, the Air Materiel Command and the Air Research and Development Command.

Senior's Pressure on R&D

Refined H. Horner, USAF Assistant Secretary for Research and Development, warned bluntly that "the pressures are mounting and growing, to become increasingly acute."

"He said his office is going to 'take a hard look at our programs, review our policies'... and test their applicability for the period ahead."

"If you assume a balanced program to begin with," Horner said, "it is not perfect in itself, all of a sudden, coming from the procurement side of the program, for example, while retaining business as usual in research and development, and still achieve a balanced program is an end position."

"Then we will have a solution in

the resources available to research and development. We cannot patch filling the slots... with components not meant offered in response into developed weapon systems.

Now we are developing systems which we cannot afford to produce, maintain or operate."

R&D Problems Cited

Horner indicated he has found some component inventory shortages in projects that do not fit the USAF program because they have gone ahead without getting a firm commitment that the requirement existed.

In his new chart of program selection, one severe problem is that capability and facilities are not always located in the same place and ready equipped with proper tools, facilities and facilities and organizations in many cases are highly specialized. Horner said, and it will be difficult to use all the resources while maintaining the competitive system to seek out the best engineering solutions for USAF problems.

"It can be seen," he said, "that a contradictory situation might be created where, as companies might propose a superior technical solution whereas preponderance of the necessary facilities

and technical manpower might be located with another company. Thus is a completely unsatisfactory solution to such a dilemma."

"One of the most important consequences may be the continuing use of analog computer contracts for development, where two or more companies are invited to jointly contribute to the development of a project, each providing the services for which they are best fitted."

Horner said he is confident the industry can work with companies to come up with a program and presented that the details will be left up to the contractors. He acknowledged that there are some complications involving proprietary information, confidentiality and follow-on procurement.

Further Budget Cuts

Secretary Douglas gave his first report to industry leaders since the recent Pentagon conference on changing USAF procurement policies (AW Feb 24, p. 16).

These developments have taken place since that time, Douglas said.

- **USAF** budget has been cut by more than \$140 million.

- **It has become "clearly necessary"** that USAF slash out-of-the-pocket fiscal 1978

expenditures by \$200 million.

- Personnel ceiling has been cut by 75,000 officials (AW Feb. 21).

Douglas gave the industry credit for seeking new economies on overhead, overhead and inventory levels but said there still is much to be improved. Too much of their costs are "among the things we have taken a hard look at," Douglas said. He urged for their action to reduce the spending rate.

On the subject of slowdown, many of which he had assumed a vendor, Douglas and USAF industries was certainly will be delayed by the action. On the other hand, he said, "we will certainly get a better product into the market, and the companies concerned can expect greater stability, then under the previous situation."

Douglas said his office is being pressed for details but that he is willing to say:

- **McDonnell** production (F-301B) should remain relatively stable.

- **Republic** output of the F-105 "will be at a very low rate until we are able to secure the required all-weather model that we require."

- **Production** rate of the Lockheed F-101 will remain, but not up to the rate planned in earlier schedules.

- **Schedule** of the Convair F-106 will not be affected but may be a year.

The secretary warned that the success of development projects has not

Bendix, Ricks Races

Washington—Four wind conditions between Chicago and Andrews Air Force Base, Maryland, in an Air Defense Command pilot in Convair F-102 jet airplane in this year's Bendix Trophy Race, held at the Air Force Association's 11th annual convention.

Winner was Capt. Kenneth D. Chordis of the 1st Fighter Group who won the 618.71 mi. race at an average speed of 679.413 mph. This was only 13.99 mph faster than last year's Bendix, speed of 665.652 mph, set between Victorville, Calif., and Oklahoma City, Okla., by Capt. Vincent J. Farnsworth, Jr., in a North American F-100C.

The F-102 pilot encountered no wind over most of the trip from O'Hare AFB and met slight head winds in the north of the Washington area.

Andrews Week was held that on a previous race prior to the AFA show was of the competing phases covered the course with a favorable tail wind at an average of 118 mph.

In addition to Chordis, pilots in this year's Bendix race who finished the 1956 record were: Col. Robert L. Gould 677.645 mph; Capt. Leroy M. Swenson, Jr., 671.501 mph; and Capt. Martin Q. Davis, 667.984 mph.

Second race of the AFA show was the Earl T. Ricks Memorial Trophy Flight for Air National Guard pilots. It was flown in Republic F-105 jets from Fresno, Calif., to Andrews with start time at Tucson, Ariz., Dallas, Tex., and Atlanta, Ga. Winner was Maj. Peter R. Phillips of the 118th Fighter Interceptor Group at Campy, Pa., who won the race in 4 hr., 13 min., 40 sec. at an average speed of 653 mph.

stopped at the limitation of the North American Nomad's engine. Stated as are being contained as a primary issue and "a member" of less urgent projects will be postponed or "left in the air."

Both aircraft modifications and new industry facilities were brought into

the picture by Douglas. USAF plans that action to slow down in new production of the aircraft coming off the line will require major modification be met, because some of the work is not just for the sake of the high cost. USAF will be "very cautious" about authorizing construction of facilities if



RAPIDLY F-105's meet rapid forward deployment at airfield. Below: a hydroplaning aircraft, possibly a bomber, is shown in a steep climb, possibly a bomber, is shown in a steep climb, possibly a bomber, is shown in a steep climb.

detail fly, shown in a steep climb, possibly a bomber, is shown in a steep climb, possibly a bomber, is shown in a steep climb.

Defense to Stop Just Pleading; Reliability Will Go in Contract

By Philip J. Kline

Washington—Defense Department shortly will reveal plans to make reliability a well-defined contractual requirement instead of merely a mouth-sought objective. New program will be the most specific and comprehensive reliability effort ever attempted by Defense Department and holds important implications for both aviation equipment and component manufacturers.

The all-out reliability program is the result of an 18-month effort by nine interagency task groups to get at the basic roots of unreliability in military electronic equipment. They worked under Defense Department's AGREE (Advisory Group on Reliability of Electronic Equipment).

AGREE Program

The AGREE program, first reported by AVIATION WEEK (March 17, 1968, p. 249) as spearheaded by James M. Bridges, Director of Electronics, Office of Asst. Secretary of Defense for the Research and Engineering.

Here are some of the "contractual teeth" which Defense is expected to reveal in introduction into future production and development contracts:

- **Required reliability**, available as imposed in terms of the percentage of total equipment delivered which must operate without failure for a specified number of hours in actual service.

- **Specific test procedures and conditions** which contractors must employ to produce to contracting officer that development, prototype or production equipment has a statistical probability of meeting the demonstrated reliability requirement prior to government acceptance.

Procedures applied to development, prototype and production units probably will differ slightly.

- **Reliability predictions**, based on extensive study of paper design and test data which shows most recognizable modes of failure. This appears certain to become mandatory for production equipment, perhaps for development models as well.

- **Demonstration of maintainability**, by means of prescribed tests under simulated field conditions in which faults must be located and repaired in a specified period of time.

There are but a few examples that indicate that the Defense Department is strongly begging industry for greater reliability and now is going to start contracting for it.

Present military specifications on components, the procedures used to prepare them, and the qualification test procedures used to determine whether a manufacturer's component meets the specifications appear due for a complete review—but on an evolutionary basis.

Task Group No. 5, which analyzed the component problem, was extremely critical of present procedures in its

final report. Present military component specifications do not insure the achievement of generally desired reliability levels," the report said.

Present MIL specs tend to reflect the test and use requirements because the environmental conditions called out do not correspond to those which the component will meet in actual use. Task Group 5 said. Furthermore, the MIL specs tend to not provide failure rate data needed for reliability predictions, the report adds.

Another serious deficiency noted by the group is the lack of "padding" to cover the manufacturer's own component but once qualified for MIL approval, data not necessarily so intensively let quality slip in subsequent production.

As a result of these recommendations, Defense is expected to make delousing changes.

- **Seasonal and geographical tests** of all components, to assure maintenance of optimal quality and to evaluate their reliability, will be required.

- **Larger test samples** will be required for qualification tests to establish failure rate data for reliability studies. Later, specifications may be revised to call for more extensive testing under variety of environmental conditions to provide data on critical component failure modes, parameter changes and relationship between failure rate and test environment.

- **In-plant quality control** to measure government standards probably will be required for MIL-approved component suppliers. Periodic Defense Department inspection and approval will be required for manufacturers to retain component qualification.

No ASPE Changes

After study of Armed Services Procurement Regulations, Task Group No. 4 concluded that no modification is needed to accommodate new reliability program. Most life, maintenance tests and other new reliability criteria can be introduced into equipment specifications in the same way that existing characteristics are now included, the group reported.

Procedures for tests intended to measure equipment reliability have been carefully designed to make them reasonably insensitive to sampling by contractors or by testing personnel. Certain inadequacies are intentionally introduced in the test procedures to make tests self-checking and reliable comparable to data recording areas, it is reported.

If Defense Department action fulfills task group recommendations these basic reliability test procedures will be applied across the board by all the services.

Standard detailed testing procedures



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Scimitar Goes Into Production

Supersonic Scimitar strike fighter for the Royal Navy has been placed in production although many advanced aircraft projects have been abandoned by the British Government. Only two features opposed to the production model in the small wing layout. Basic design is at least eight years old and has produced numerous variants.

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to the
tempo of
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and roles for administration will be used by all generating agencies.

Only those tactics peculiar to the type of equipment and its residual characteristics will be left to the discretion of the procuring agency, if full-group recommendations are accepted. Items that can not affect the results of the reliability evaluation, but which might determine testing equipment, will be left to the option of the procuring agency, or contractor.

Figures for minimum acceptable life (as defined for different types of military electronic equipment were determined by Task Group No. 1.

The Task Group analysis did not include remote base equipment, so early sensitive equipment in large data-handling systems like SACG or Minuteman.

One of the study has come a realization of each major type equipment according to major service, giving minimum acceptable mean life to failure. These figures form the basis for new Defense Department specifications.

Some equipment types appear in more than one table, because of the difficulty of making life requirements depending upon how the equipment is used actually. This means that the procuring agency must fully study each value on the longest mean life to the present; the same equipment to different reliability standards. The former appear more likely.

Task Group 1 acknowledges that its acceptable figures are only best estimates and should be revised if further study provides more valid information.

Other recommendations made by the task groups, which apparently stand a chance of Defense adoption:

- **Supporting test equipment**, open, training material should be purchased at some time that contract is awarded for production of new equipment.
- **Single set of environmental test conditions** for component failure rate evaluation should be adopted by all services.
- **Procurement industry-airframe group** should be formed at Defense Department level to develop new standards, component specifications and develop better inspection techniques. Group would also accumulate data, failure reports, work to improve capabilities, manufacturers' quality control data and actual field experience.
- **Formation of independent reliability group** to separate industry's efforts to increase production and quality. Task Group 2 and the group would not be subject to interests or prejudices of project personnel on the staffs of the contractor or procuring agency.

Reliability Research Dept. of Aeronautics and Astronautics at Aeronautics and Astronautics is conducting a review of types of issues for Defense Department.

Air Force Evaluation Is Likely For Three Competing HF Systems

New York—Air Force evaluation of three new high frequency communication techniques, each competing both for both military and defense contracts to replace amphibious (AM) systems, appeared likely last week.

Rome Air Development Center, currently conducting fully automated and-boards flight experiments of the Collins representative single sideband system and General Electric's trackless detection, will select the compatible single sideband system developed by Kahn Research Laboratories pending it can be located the Center.

Speculations for Kaiser Aircraft and Electronics Co., which holds military rights to the Kahn system, says it hopes to make out details this week and it appears that negotiation can be delayed to Rome within 90 days.

Kahn earlier agreed to lease to Aeronautical Radio Inc. an adapter for converting one of Aeron's New York defense transmitter to enable it to evaluate the common and problems of such equipment in the event the Air Force adopted the Kahn system.

Air Force recently had to arrange an informal service evaluation of the Kahn and Collins systems, although Alan W. Williams, Chief of Staff, says they are not the original objective of making the Kahn installation at New York. Collins tentatively agreed to supply its equipment to Aeron, later withdrawn.

The selection, according to its spokesman, was:

- **Major international carriers** behind results from New York installation tests would not prefer possible and expense of installing Collins reference equipment. They believe that installation should be made at Gander and/or Shannon, London to determine which system is superior under critical North Atlantic operating conditions where atmospheric conditions may create frequent outages at existing AM equipment. (Kahn has transmission can be carried with AM equipment.)
- **Lowest current production** of single sideband equipment, coupled with heavy military demand, made Collins reluctant to direct for Army tests in view of commercial carrier's attitude.
- **Navigation tests already in order** was on Collins and Collins system by Rome, Air Development Center Strategic Air Command and Navy.

These Collins can, should be selected to establish its merit.

For American and Trans Canada Air Lines representative is negotiating with Aeron, which has that device shelter results of the proposed Aeron

competition would partly effort to put together in them.

For Air transport tests at Gander and Shannon, London.

Collins recently visited TGA to conduct its and in setting up a single sideband installation at Gander for service evaluation in the North Atlantic, a TGA official told Aeronautics Week. TGA talked Collins out of the move because it believed such action is premature at this time; the official says he believes the North Atlantic carrier first must find a better definition of their communication problem to determine whether present AM should be abandoned before trying to resolve critical needs of single sideband.

Kahn has publicly used the question of who "Collins refused to enter into competitive, single sideband tests." One company official says the Collins system is not feasible for air ground use and that this can be proven in the New York tests without expense and trouble at North Atlantic installation.

De Jersey Virginians, chief of staff of Rome's Communications Laboratory, says in flight tests show that "telephone quality" can be obtained with the Collins system over distances of several thousand miles. Tests have been run at 14, 21 and 28 mc. Virginians says that the GE communications data test station's performance generally as required that of single sideband equipment.

Rome has installed experimental station CTH to provide a scientific basis for comparing performance of various radio test. Magnetic tape with pre-recorded messages and words designed to test attention are alternately transmitted over each system both ground to and air to ground. Recorded message is recorded on tape for analysis.

Britannia for TWA?

Washington — Agreement between Howard Hughes and British European Company for the purchase of a first of British European jet Trans World Airlines last week hinged on the outcome of British interlevel discussion on the transatlantic. Because the purchase of Britannia by Hughes would require British Overseas Airways to relinquish routes for its Britannia; top-level preliminary opinion is necessary. BOAC has internal opinion on 14 of its 39 British jets, probably would fill the equipment gap in solving DC-7Cs at a substantial dollar gain for England.

CAB to Give CAA Airspace Control

Bitter issue appears to be headed for settlement; military withholdals comment pending further study.

Washington—In an unprecedented action, the Civil Aeronautics Board last week proposed to give the Administrator of Civil Aeronautics authority to resolve the bitter controversy between military and civil aviation over the allocation of 51.5 air space (ISW May 27, p. 21 and p. 46).

Effect of the ruling would be to strip the Air Coordinating Committee's Airspace Panel of its present authority to handle airspace conflicts. It also would avoid the rights of the military command to declare large areas of airspace closed to non-military aircraft, except in the case of enemy attack or other national emergencies.

Under the proposed Civil Air Regulations, the CAA administrator would have the power to designate restricted areas which he feels a "hazard to aircraft in flight exists." He also would have authority to revoke or modify any restrictions that interfere with the safe operation of aircraft.

Airlines Appeal Action

Airlines move quickly to appeal the Board action and the move is expected to help cause a "faster allocation" of airspace.

Defense Department said it preferred to withhold comment until it had reviewed the proposal further.

Defense and other interested parties have 35 days from the July 30 Board announcement in which to submit comments on the proposed ruling, but it is doubtful that the Board will change the legislation substantially.

Two principle features of the proposed regulation are:

- **Establishment of airspace restrictions.** CAB has the statutory responsibility for establishing airspace restrictions and has delegated this authority to the CAA administrator. Under provisions of the new ruling, the administrator may designate restricted areas on petition of any interested party, or on his own motion when he feels this necessary to the safety of aircraft in flight. He also may impose time, conditions and limitations on restricted areas and may revoke or modify restrictions where required in the public interest.
- **Military compliance of air traffic rules.** The proposed ruling will permit the military force to conduct operations "necessary to the conduct of national defense" but will bring to a halt any right to exercise such authority on other areas of operation without prior approval of the administrator. Transit and operational airspace which require a deviation from civil air regulations can be authorized by the administrator through the issuance of waivers. The Board emphasized that the ruling is being proposed to clearly present regulations which it and the military must be used to guide airspace placement with air traffic rules in such operations as combining training areas.

Appeal Review Provided
Under the regulation, the Board has the right to review the administrator's actions.
Furthermore, interested parties will have an opportunity to submit comments on any airspace action the administrator may take.

In its earlier of proposed rule making, the CAB called airspace a "national resource" that is "diminishing rapidly," and stated: "It is no longer easy to meet the needs of users by merely allocating airspace piecemeal undisturbed by other users."

The Board emphasized that growing operational needs have created a central problem. It pointed out that in the last several years, civil airspace mileage has doubled and the number of military airspace requirements has increased more than 15%. The Board added:

"The problem of diminishing airspace has become so acute that the government can no longer accommodate all the needs of individual users and must, primarily through the selection of all users to designate what is most in the public interest."

Emergency Rule Hit

The Board emphasized the need for emergency agreement within the Airspace Panel of the Air Coordinating Committee before any airspace action can be taken and charged that such pressure stemming from this voting procedure has not always been a "public interest."

Airlines previously have opposed the voting structure of the Airspace Panel and have protested that civil aviation representatives on the panel has always been outnumbered by the military in deciding airspace problems. The Airspace Panel consists of six voting members—Air Force, Navy, Army, Department of Commerce, Civil Aeronautics Administration and Federal Communications Commission. Commerce represents the CAA and other agencies under its jurisdiction have no vote.

The Board admitted its dual role in the proposed regulation that more problems have been resolved by the Airspace Panel.

"It is now apparent that it cannot cope with the complex problems of diminishing airspace on the one hand and increased need for airspace on the other."

Prior to the public announcement of its proposal, the Board held a hearing on the proposed regulation in a hearing room in the Department of Defense, should by Louis Rothblat, Commander Under Secretary James F. Ely, Administrator of Civil Aeronautics. Lt. Gen. Edward Goodson, special presidential assistant for aviation planning, and representatives of the Department of Defense, Air Force, Army and Navy.



Comet 4 Fuselage, Wing Mated

Fuselage of first Comet 4 jet intended for British Overseas Airways Corp. is mated to wing at the final plant at Hatfield, England. The airplane, with a 131 ft. total wing and mated by four Rolls-Royce Avon engines to be installed soon, will fly only next year.

Immediate Fare Increase Vital To Early Jet Use, Airlines Say

By Food Stations

Washington—Failure to approve a passenger fare increase immediately will depress the marketing of jets as a jet air service for several more years airlines told the Civil Aeronautics Board last week.

The warning was made in oral arguments before the CAB in the expanded passenger fare increase proceedings, in which some domestic carriers applied for a 5% increase in an emergency measure pending outcome of the general passenger fare re-evaluation.

The Board is expected to announce its decision soon on the emergency request.

Rising costs and dwindling profits at a time when the industry needs a tremendous amount of money to develop new equipment has placed airlines in a critical financial situation which necessitates immediate action, carriers argued. Before airlines can attract needed funding necessary to purchase the new equipment they must show a better earning record, they said.

Bureau Opposition

CAB's Bureau of Air Operations opposed the request, arguing that as a result of relevant considerations that current still operate on current opportunities to achieve the financial savings. The Bureau recommended that CAB deny the emergency application.

It based its case on the following:

- Carriers have reported double cost increases in the recent past. Each of the seven airlines, except Northwest, will increase ticket rates in excess of 5% during the seven year period from 1950

through 1956 and the recent agreed as high as 12.50%.

General economic outlook for the American economy is bleak. Excessive crowd traffic volume and technical advances, including larger and more efficient aircraft, have created serious problems in absorbing price and wage increases without an increase in the cost of production of available materials. This situation confronts all major industries in the fact that their cost of production has continued to rise.

Recent fuel additions of large foreign aircraft, after fuel requirements increased in 1957, will result in an increasing proportion of traffic being carried on larger and more efficient aircraft types. This will contribute to current opportunities to control fuel costs.

Industry has asked substantial funds for its equipment needs. In the last two years domestic freight carriers have raised more than 500 million dollars in new money issues. Airlines have raised more than 100 million dollars in new money issues. Airlines have raised more than 100 million dollars in new money issues.

The Bureau Council concluded that the current could do even better than could, through more economical and efficient management. An analysis of the carriers' operations made in the light of the statistics, standards, the Bureau Council said, show that:

- Failure to operate at reasonably attainable passenger load factors is depressing earnings.
- Carriers have included excessive depreciation charges and excessive allowances for federal income taxes in their reported and forecast earnings.
- Excessive purchase discounts are not part of the rate base.

As a result of the Bureau's January 1957 forecast reflected profits far greater than the carriers themselves predicted. Airlines likewise predicted the bureau's conservatism in predicting and degrading the purpose of predicting a pessimistic forecast to oppose the increase.

George Squire, Trans World Airlines general counsel, said: "While the airlines wish a lightening of present bankruptcy and advocate the Bureau of Air Operations which can bring about a situation which ends today and tonight in speculation of profit making in years to come."

Squire said meetings for the domestic trunk carriers have developed to \$14 million for the first five months of 1957 compared with \$37 million for the same period last year. "This," he said "is a clear tribute to a gradually increasing economy in the period ahead." Reflecting on the depression which confronted the industry between 1946 and 1949 Squire said none of the economic problems made by the CAB staff over materialized.

Richard S. Mason, Delta Air Lines vice president and attorney, urged the Board to "think the line faster to permit airlines to continue to provide the American public with the best air transportation system in the world." Mason said the nation's airlines have reached the limit of their ability to set rising operational costs through better technological advances and more efficient management. He also said there has been no public opposition to the proposed 5% fare base.

Northwest Price

A similar appeal was made by C. E. Wood, Northwest Airlines vice president, who cited recent gains for the company but dwindling profits. Northwest is one of the first major airlines that has not announced proposals of fare increases with which to purchase jet equipment.

If Trans World, Brown, United Air Lines attorneys, told the Board that the industry could be reasonably dissatisfied with the level of earnings continuing during while traffic continues to increase.

Despite recent favorable earnings, Brown and airlines said to act upon a financial standing which makes needed capital funds available. During the first six months of this year United's operating income increased 12% over a similar period a year ago, but operating expenses were up 15%. He said the company's operating profit for the first half of the year was down 95% as compared with the first six months of 1956 he said.

Other airlines presenting arguments along the same lines include Capital Airlines, Eastern Airlines and American Airlines. Eastern Airlines said it was not an original applicant, but filed for the increase last week.

Three Lines Discuss Turboprop DC-7s

Seattle-Maine-Representatives of United Air Lines, American Airlines and Flying Tiger Line met with Douglas Aircraft Co. officials here last week to discuss plans for use of turboprop versions of the DC-7.

United appeared to show a strong interest in the DC-7E prototype version of the proposed aircraft while American and Flying Tiger Aircraft the DC-7D, which will be designed initially as a cargo plane. Both models will be powered by Rolls-Royce Trent engines.

Base price of the aircraft is reported to be just under \$5 million. Problems for all three airlines in financing, since both American and United are heavily committed on large fleets of other turbine-powered aircraft and Flying Tiger recently purchased a fleet of 13 Lockheed 1460s.

Both DC-7 versions are 30 inches wide and 30 inches longer than the DC-7C. Overhead engines will be added further out and in will be swept off.



TUPOLEV Tupolev 104 jet transport bears a family resemblance to the smaller, two-engine Tu 104 (AW July 22, p. 27). Avion package also appears to be new, placed in fuselage section forward of wing leading edge. Overwing fuselage window arrangement is identical to Tu 104. Tailport will carry 106 passengers, compared to 50 in Tu 104, up to 180 in Boeing 707 or Douglas DC-8.

Aeroflot Told to Advertise, Push Sales

Aeroflot, Soviet-owned airline, is launching the biggest advertising and promotion campaign in the history of Communist civil aviation on an order from a high-ranking agency of the USSR Council of Ministers.

The government instructions to the airline to "propagandize" its services coincide with an important reversal in Russian basic attitude toward advertising. Although Soviet officials still claim that capitalist advertising is based on falsehood and deception, they now admit that "truthful and informative" Communist advertising is good and necessary.

Aeroflot has started its campaign with the placement of bill-boards, color ads in USSR's most popular magazines,

Ogarek, which has a circulation of 1.2 million. The ads feature the Tu 104 jet transport and list all the points served by the new linerjet.

A few enterprising Aeroflot subsidiaries are distributing "petersonic" brochures and promotion literature among the general population. The Civil Administration of the Civil Air Fleet, the agency running the advertising order, suggested that other Aeroflot subsidiaries must adopt this "advanced method of merchandising."

The Civil Administration told the Aeroflot management that the campaign's publicity and information programs is far from satisfactory in view of the airline's rapid growth. This agency added:

"At present much of the money allocated for advertising and information is not being used. Some of the advertising sheets which are issued are poorly prepared and do not give the reader a clear impression of the benefits received by the Soviet people using air transport service."

"What is needed," the Civil Administration declared, "is for Aeroflot to make serious efforts to propagandize the advantages of air transportation. The population must be kept informed concerning the work of our airlines."

Along with the advertising, the Civil Administration called for the establishment of additional airline ticket offices in hotels, railway stations, day tour centers and other strategic locations to



AEROFLOT ad in recent issue of Ogarek. Plane is Tu 104.

serve the public better. It complained that "owing to the negligence of Vostochny Aerial Division Zolotnitsa plane tickets are sold at only five places in Moscow."

The switch in attitude toward advertising by the airline was preceded by the USSR Ministry of Trade review of Russian trade organization managers "who held an incorrect atti-

tude regarding the objectives and tools of commercial advertising."

In the opinion of these standardized persons, the Trade Ministry recently announced, advertising is necessary only as a means of selling surplus commodities.

It there are no surplus goods for sale in Aeroflot's case, then according to the opinion of these conservative administrators are entirely unnecessary as a means toward Soviet advertising strategy.

REAL Buys B80s

San Diego—REAL-Aeroflot, Russian International Airline, has purchased four Comair 800 jet transports at a cost of over \$27 million. It plans to place them in service from Boston Area in Chicago via Miami also in 1960.

REAL now operates the Chicago route with EC-7s and uses the Comair 800 and 806 as its western fleet, Argentina and Paraguay. Delivery of the four jet transports is scheduled for late 1959.

The REAL order brings total 800 sales to 49.

Cities Will Be Ready For Jets, Douglas Says

San Francisco—Cities scheduled for the first commercial jet service generally will be ready for the jet within the time frames, Donald W. Douglas predicted in a recent address to the American Society of Newspaper Editors meeting here.

"I am convinced there has been an undue amount of concern about our readiness for the jet age," Douglas said. "Continuous improvement of our airports is a matter of national policy which usually receives strong support at the community level and which, in general, is proceeding very well."

Extension of jet service to other than coastal cities will come as a gradual and orderly process, the Douglas Aircraft Co. president and board chairman told the editors. Most of the major airports which accommodate and intercontinental flights already have adequate runways to handle the DC-8, Douglas said. Airports with 7,000-8,000 ft runways can generally be expected to handle the DC-8, and the longer runways in this range will be needed only for cities where the longest flights originate. These cities, Douglas said, already have or soon will have runways that long or longer.

Extensive new runways will be the greatest problem in preparing for jet operations, according to Douglas. But the problem is being given high priority, he said, and cities require manufacturers, he said, and jets will have several improvements when they go into operation.

Manufacturers are in use of the intercontinental jet transport aircraft and all other large jet aircraft. The intercontinental services Douglas pointed out and "the planes are not designed in dreamers' own towns." At all times the manufacturers must direct into one conclusion, the manufacturer in which the aircraft must operate, Douglas added.

Electra Engines Flown

Los Angeles—Specially modified Super Constellation fitted with four Allison 361 jet engines capable of 4,000-hp and 4,000-hp fuel-bled props, the modification planned for use on the Lockheed Electra transport was test flown for first time at Burbank last week and just through a set low flight schedule.

The new first time test Electra power plants have been flown on a single engine.

Flown on an RTV-2 Navy helicopter aircraft, and is scheduled for 1,000-hr engine flight test program simulating engine behavior.



LOCKHEED carries eight the Electra with a maximum speed of 650 mph; a cruising speed of 500 mph at 30,000 ft, and a maximum weight of 26,000 lb. Engine design is officially confined to Lockheed. Thrust is estimated at 24,500 lb.



Dr. Dorothy M. Simon, Technical Assistant to the President of Avco Research and Advanced Development Division, addresses a symposium of the Advisory Group for Aeronautical Research and Development (SARTO) in Cambridge, England.



The Avco Research and Advanced Development Division, as seen in the wicketed, wide track, is a new major construction in Woburn, Massachusetts, a suburb 10 miles northwest of Boston's central hub. Scheduled for completion in early 1968, this ultra-modern laboratory will house the complete test and research staff of the division.

Avco's new research division is now offering unusual and exciting career opportunities for experimentally qualified and forward-looking scientists and engineers to seek with us.

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Write to Dr. E. W. Johnson, Executive and Technical Editor,
Avco Research and Advanced Development Division,
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THE NEED TO KNOW

Man has long been motivated by the need to know—to know what lies beyond the oceans, the mountains and the sky, to know what elements make up the earth's crust and what forces control the universe. Many questions have been answered, but as our knowledge increases and the boundaries of our space expand, new questions are asked.

In the AVCO laboratories, exploratory work is under way in many fields of physics, physical chemistry, metallurgy, and engineering. Basic research and development are continuing in fields where we have already made contributions: high-speed aerodynamics, ICBM re-entry problems, physics and chemistry of air, heat transfer, electronic applications to advanced radar and computing, and high-temperature materials.

New ideas for future work are being discussed by the creative scientists and engineers who are members of this division. The scope of these new problems is so broad that the joint efforts of these from many disciplines are required for their solution. The future promises to be challenging.

A new research and development center, designed to give a proper physical environment and to provide the facilities and equipment needed, is under construction. This center is located near large universities to make available educational opportunities and wide professional contacts.

In the short period of our existence as a research and development division, much has been accomplished—problems have been solved and we have learned to work together. Now we are beginning to broaden the scope of our work and to add our contributions to the technical world, thereby strengthening the position of Avco and helping to satisfy man's need to know.

Dorothy M. Simon

Dr. Dorothy M. Simon
Technical Assistant to the President

AVCO
RESEARCH & ADVANCED DEVELOPMENT



CIVIL AERONAUTICS ADMINISTRATION is conducting high altitude tests of navigation aids with two B-57s on loan from the Air Force. Each aircraft is being painted in CAA official orange and white colors. Shown standing the inside of one test window on airborne equipment are (left to right) CAA official Thomas L. Sheppard, Administrator James F. W. and Robert Lockhart, chief of flight altitude flight inspection.

CAA Tests Jet Age Navigation Aids

Washington—Civil Aeronautics Administration has begun a series of high altitude flight tests to determine the effectiveness of its navigation aids in jet transport operations. Tests are being conducted with two B-57A fighter bombers, which have been converted into flying laboratories and borrowed from the Air Force.

Naval adopted program is designed to check the accuracy of jet aircraft and to test new jet transport facilities in a search and development tests. Developed by Arthur Fiedler, CAA's chief of flight inspection, the program will suggest CAA's present low altitude flight test program.

For the test, the high altitude flight inspection program will be devoted to checking the problems associated with electronic navigation aids at altitudes. New concepts of air traffic control also will be tested. On completion of the feasibility identification program, CAA will determine the degree to which navigation aids will be checked at high altitudes to detect flight inspection program.

Aircraft Facilities

The B-57s will conduct tests at altitudes between 30,000 and 50,000 ft.

To accurately establish aircraft position, two jet transport DME type signals obtained from VORTAC or DME ground stations are used. To determine position as far as that might occur if conventional airborne DME indicator were used, CAA employs a Hewlett-Packard digital counter to measure transit time between transmissions of pulse from airplane and receipt of reply from

ground station to within one-tenth of a second.

Test tests with the Philadelphia, Pa., VORTAC demonstrated that the signal can be positioned accurately within plus or minus 100 ft. at 40,000 ft.

Consolidated Electronics Corp. radiography, research are used in 3-17 to record digital counter readings (going DME pulse transit time) as well as simultaneous readings of bearing signals from two jet transport VORTAC ground stations. Data is recorded on 178 ft. roll of recording paper that moves at 10 in. per minute.

Computer Use

Information obtained from each flight test is later fed into a Federal Bureau of Investigation Corp. 704 computer which performs calculations required to establish airplane position from DME data. Computer also calculates corresponding airplane position from VORTAC or VORTAC bearing data. Differences between the two apparent errors in the VORTAC or VORTAC bearing signals.

To meet maximum accuracy in establishing the aircraft from the Coast and Georgia River is measuring the location of all CAA VORTAC stations to determine their exact location in longitude, latitude and elevation.

One obtained from the IBM computer gives aircraft's location at the time of each test or reading within 1/100 of a second in azimuth and within 1/1,000 of a statute mile in terms of ground distance.

Present CAA flight inspection program consist of a basic program using

DC-7s to check facilities between 700 and 15,000 ft. altitudes, and an intermediate program that employs Cessna 440s to test facilities at altitudes between 10,000 and 20,000 ft.

According to CAA Administrator James F. W., the high altitude tests with the B-57s will supplement the basic and intermediate tests which are not too slow a system and not sufficiently accurate to get agreement. Fiedler added that the B-57s will permit testing under all weather conditions and will enable the CAA to reach sufficiently high altitudes to learn whether the efficiency of the navigation aids decreases as altitude increases.

Darkness, Weather Blamed in Crash

Washington—Darkness and adverse weather conditions in which the pilot could not maintain control of the aircraft was cited by the Civil Aeronautics Board last week as the probable cause of an Alaska Airlines plane crash near Nome last Oct. 2. Five occupants of the aircraft, a Douglas AT-49, were killed.

The CAB said it believed the pilot without instrument training, completely lost visual contact in a snowstorm, lost control and struck the ground on a steep ascent. The flight was en route from Council to Nome and crashed 15 miles from its destination, the CAB said.

The board added that operations specifications of the aircraft restricted its operation in the area to day only, but that it was probable that fatal crash was caused at the time of the crash.

Lake Central to Launch Big Expansion

By L. L. Doty

Washington—Lake Central Airlines is launching a far-reaching route expansion and refinancing program that it has had in progress for more than two years while it waited for a final ruling on the long-drawn-out question of merger with North Central Airlines.

With Civil Aeronautics Board disapproval of the proposed merger last month (AW July 15, p. 35), Lake Central has been freed of what the CAB bureau counsel once called the "hemping effect of the pending acquisition." The CAB decision also virtually places ownership of the airline in the hands of company employees and officers as a result of a stock-purchase option which was exercised in 1955, but was subject to the prior rights of Lake Central.

Unkempt System

If the company's route development program materializes, the entire system—encompassing 31 cities in the Great Lakes region, between St. Louis and western New York—will be reduced to change traffic flow from a generally East-West to a North-South direction. The program also

will introduce to the local service industry the "arm concept" of airline operations, a significant expansion that will grant Lake Central greater flexibility in establishing a service pattern within its routes.

Meanwhile, in a major move to strengthen its state, financial structure, the airline has taken its first step in a long-range refinancing program. It has filed with the Securities and Exchange Commission a prospectus for the issuance of \$100,000 in convertible subordinated debentures at 6 1/2%. Later plans include bank loans totaling \$500,000 to be secured by client mortgages or assets and the completion of a long-term note agreement for an assumed loan of \$500,000.

Lake Central officials expect the debentures will be purchased by the employees, providing a public offering. The offering will be made through the company's officers and directors under an underwriter. About \$100,000 of the \$100,000 will be used to retire outstanding accounts payable and the balance will be used to improve the airline's cash position.

Officials from the debenture sale will provide a significant boost to Lake Central's financial structure, which showed current assets of \$479,000 as of March 31, compared to current liabilities

of \$919,000. The additional capital also will give further impetus to a re-schedule traffic growth pattern that brought a total of 135,735 passengers in 1956 compared to 127,577 in 1955. The year following the airline's operation. In the same period, the company's passenger load factor has climbed consistently each year from 36% to 43% and revenue-per-passenger has jumped 1 million in 1955 to 2.1 million in 1956.

Contract Delayed Recepticalization

That no constructive steps had been taken earlier to adjust the substantial underfinancing and undercapitalized condition of the company to coincide with the steep rise in passenger traffic can be attributed chiefly to the 1951 contract between the original owners and North Central Airlines for the sale of 97% of the outstanding common stock to North Central. Stockholders at that time were awaiting a long-term pending CAB approval of the sale. Lake Central was legally precluded from raising any securities which would alter the equity or voting rights of the stock.

But in 1954, the stockholders who had offered the stock to North Central gave the Lake Central officers and employees an option to purchase the stock subject to the rights of North Central. The option was exercised in January, 1955.

Decried by the CAB disapproving the acquisition of Lake Central by North Central under the 1952 contract and given exposure to the Lake Central legal and officers, subject to any available legal recourse, Lake Central officers are faced with a problem for reorganization as filed within 30 days or as typical to the Central Coast of Appeals is filed within 90 days following the decision.

Significance of the ruling is underlined in a statement by CAB as former Paul W. Mueller in his current recommendations opposing the merger. It is apparent that whichever group is successful, successful in securing control of Lake Central, it will be all problems, others an excellent bargain for the price paid," Mueller said.

About 138 of the 185 employees are stockholders and no individual owns more than 5% of the shares outstanding.

Stock is held under a voting trust contract which will be terminated upon final determination that the original 1952 contract is valid and subject to no further legal recourse.

Given Hicks, Lake Central president told Aviation Week that the "long

period of inactivity" over the merger with North Central has been a strong deterrent factor in the development of Lake Central, he said. "Inevitably, just as a building spell in which to develop a detailed, comprehensive program."

Hicks pointed out that the airline has never had a main action of its own but has always operated over a dependent series of agreements that have been cut off by the immediate company. Present route structure fails to coincide with the true feeder-bus principle since it does not permit a convenient flow of traffic from similar communities to major traffic hubs, he said.

Structure Significance

The feeder-bus structure will be of more significance later when operations of the long-range jet transport are confined to the major traffic area. Hicks said.

He tied in the route structure to the local service to support such plans by saving the traveling public will cost them to go from their jet hubs to an unimproved service elsewhere. He said.

Hicks went to the route structure to point to great growth data on North-South operations between the Great Lakes and Ohio River cities through the over Lake Central service in Indiana, Ohio, Michigan, Illinois, Pennsylvania and New York. In this way, he hopes to establish "natural bridges" that will be non-competitive with the trunk routes but will strengthen Lake Central economically with heavy traffic.

Furthermore, Hicks noted that the Great Lakes-St. Louis route would eventually cause a sharp economic adjustment in the economic structure of the Midwest and will establish such Great Lakes cities as Chicago, Toledo, Sandusky, Cleveland and Buffalo as major ports, causing a diversion of traffic from eastern seaboard ports.

That he was not at last stage of the merger he noted in a report on the winding of the recent CAB decision. The Board found that prospects for Lake Central's future in its independent service are "more favorable than pictured by the committee," who earlier had recommended the merger with North Central.

Pending Proceedings

In addition, the Board stated that pending local use proceedings—wherein the Great Lakes Local Service Case—was better "adequate" for strengthening the airline from the present merger.

Hicks said it is a pending proceeding, involving routes, schedules, possible planning in route structure. He pointed out that he discussed his plans



Production of the Fairchild F27 in order by the Fairchild Aircraft Co., plant at Muskegon, Mich. Here also is a look inside the wing center section, upper part prior to being loaded. More than 30 orders and options have been placed.

F-27 Wing in Production

Production of the Fairchild F27 in order by the Fairchild Aircraft Co., plant at Muskegon, Mich. Here also is a look inside the wing center section, upper part prior to being loaded. More than 30 orders and options have been placed.

with the management and economic recorders of airlines operating through the Lake Central area before applying to the CAB for new routes. Consequently, he said, the airline's position from the trustees when last up in the Court Lakes Local Service Case was minimal here.

Each city involved in the route applications was considered and provided with a detailed schedule of its passengers.

Hicks also confirmed his findings with utility companies, particularly the telephone companies in the area, which consideration, to make certain that his long-range planning coincided with the thinking of other interests.

Lake Central operates a fleet of 19 DC-6s over 1,500 miles of routes. Gross revenues were \$2,739,965 in 1955 compared to \$2,284,044 in 1954 and \$2,301,491 in 1953. In 1956, the airline showed an operating income of \$1,142 and a net loss of \$30,779.

The airline reported its last route certificate of Jan. 1, 1957 and has been operating under a temporary certificate since then. Federal orders during the first quarter of 1957 were \$190,751 and total operating income was \$718,835.

Headquarters of Lake Central are at West Coast Airport, Indianapolis. Records of the airline consolidated its maintenance and general office facilities under one roof and after operating at 13 different locations in the past, since the airline was organized in 1949. The move has not cost by 5 cents an airplane mile.

Airport Nuisance Suit Lost by Plaintiffs

Los Angeles—Noise and nuisance suit by 15 families living near Van Nuys has been won by the City of Los Angeles, defendant in the case. Damages were denied the plaintiffs, who totaled 75 adult males, and the Superior Court judge also ruled that the city was not liable to assess costs of the suit from the plaintiffs.

The suit, contended that the airport was located prior to the time that use of the plaintiffs' acquired property in the vicinity. It also denied any authority over the municipality of aircraft in the area as a central responsibility of the Federal government.

The case was known as Carl G. Allen and 15 others vs. City of Los Angeles, at 11 West 2nd St., Los Angeles.

SHORTLINES

► American Airlines will begin Douglas DC-77 seating service between St. Louis and New York on Aug. 13, and will begin Indianapolis-Douglas DC-6B service from New York to Cincinnati, St. Louis and Los Angeles on Aug. 15. Under the new DC-77 schedule, American will offer 24 non-stop flights weekly between St. Louis and New York.

► United Airlines has signed interim traffic agreement with three foreign air-



MAP shows present routes and what Lake Central has applied for. The extension would take the airline into Washington, Louisville, St. Louis, Mo. and Milwaukee, Wis.

NOW! THRU ONE-CARRIER SERVICE FROM ALL THE WEST!



WESTERN AIRLINES

Champagne Flights to MEXICO CITY

Now you can enjoy the incomparable luxury of Western's world-famed "Champagne Flights" all the way to Mexico City! Reserved seats, gourmet dining, vintage champagne and cocktails for the ladies—at an extra fare—will make your flight to this friendly and fascinating country seem all too short. No longer do you have to change airlines. Now you can enjoy America's smartest air service all the way to Mexico City on Western Airlines!



WESTERN AIRLINES

been operating over transatlantic, European and Latin American routes. The carriers are Icelandic Airlines, operating between New York and Iceland; Daily Swedes, Ltd., operating only in Europe; and Transpacific Aeronautics, flying between Miami and Central and South American ports. Agreements will allow for passenger and air cargo transportation on United's routes and each of the other airlines by means of a single ticket or an overlap.

• **Chalk Air Lines** flew 270,343 lb. of air freight during June, nearly double the June, 1955 figure of 137,550 lb.

• **Air France** will begin Lockheed 1649 Constellation service between New York and Paris on Aug. 15. The flight, leaving New York on Sundays, offers both first class and tourist seating. Air France began operation of its "Golden Parrot" service, using the 4649, on Aug. 2. These tourist flights offer private compartments with bed facilities and are limited to 32 passengers.

• **Vary Airlines** of Brazil flew 515,414 passengers during 1955. The airline reported that was a 21% increase over the previous year. Other figures for 1955 are: passenger miles, 213,109,663; cargo, 44,973,825 lb. and freight and domestic mail, 550,291 lb.

• **Northeast Airlines** carried 43,363 passengers between July 1 to July 15 as opposed to 31,173 in the same period last year. The carrier announced that load factors on some Boston New York-Miami flights rose to highs in 1955.

• **Leffmann** and **Air France** have signed an agreement whereby each carrier will be represented by the other, in areas mutually served by the other. This means Leffmann will be general agent for Air France in West Germany and West Berlin and Air France will be general agent for Leffmann in France, North Africa, French West and Central Africa and in Asia. New representation will end after either carrier's office in France and Germany.

• **Ridale Airlines** is being 200 mailmen to deliver newspapers Florida. To facilitate quick delivery of BMW 300s, a Florida distributor decided to stop the sales by Ridale to meet demands by Florida dealers.

• **Northwest Airlines** began operating re-equipped Douglas DC-7Cs on all its daily flights over the North Pacific to and from Tokyo, Okinawa and Manila. Northwest has been using a combination of Lockheed Super C-130A and DC-7Cs since April.

AIRLINE OBSERVER

• **Watch for an early announcement by British European Airways** on the purchase of jet transports. Strongest possibility appears to be the Bristol-144 Constellation to be used as an "admiral" type in complete with the Sud Caravelle. An European member BEA also is interested in the four-engine turboprop Bristol 200 (AW May 27, p. 41) for the 1963-3 period to complete with the larger and faster design expected to be in operation at that time.

• **Civil Aeronautics Administration** reports a 10% increase in the number of aircraft operated in U. S. scheduled services during 1956. Airlines operated 1,497 aircraft as of January, 1956 compared to 1,373 planes as of January, 1955. For the first time, the number of four-engine transports exceeded the number of two-engine planes, although DC-5s continued to be the most numerous of all models, representing more than one-fifth of the total U. S. fleet.

• **Chances of Congress** taking final action on pending aviation bills this session are 50-50 by some observers. To be this session of the civil rights debate. But backers of such measures as capital gains, equipment trust and guaranteed loans still are hopeful that the slight congressional opposition to these bills will ease the way for approval before Congress adjourns.

• **Pan American World Airways** has been allotted a \$13,500,000 contract by the Air Force for further work on the Air Force Missile Test Center at Patrick Air Force Base, Fla. Arrangement with Pan American for operation and management of the test stage dates from late 1951.

• **Capital Airlines** last week won its appeal before the arbitration panel of the Air Traffic Conference that it had not violated rules pertaining to the certification of travel agents. It was the first time any airline has refused to accept a ruling and pay a fine of ATC's enforcement office. ATC regulations prohibit open houses at placed parties at travel agent conventions although there are no restrictions on informal entertainment of agents in hotel rooms. The arbitration panel agreed with ATC that its enforcement fell into the category of a membership of the American Society of Travel Agents in Chicago last November.

• **Sandermann Airlines System** is expected to be granted traffic rights at Washington on the carrier's transatlantic route between Los Angeles and Copenhagen. SAS presently operates into Winnipeg for refueling only. Similar rights are expected to be given to Canadian Pacific Airlines at Edmonton on its route between Vancouver and Amsterdam. Canadian government will examine the full application of airlines being the transatlantic routes and seeking rights to handle passenger traffic in Canada.

• **Air Line Pilots Assn.** and the **Civil Aeronautics Administration** have taken opposite views on whether the Civil Aeronautics Board's decision to revoke the suspension of TWA World Airlines pilot Leonard Spedick has created pilot emergency authority (AW July 18, p. 49). CAA claims the Board's unprecedented action since clearly the ALPA feels the decision puts the case even further in doubt. Both sides will wait for the Board's written opinion before taking any action.

• **Bonanza Air Lines** recently cut ahead of a new designated hotel at Kansas Airport, Ala.—the local Little League baseball team. The boys seeking telephone poles for lights to illuminate night games were given permission to mount the support for its poles out in the field, when the Bonanza owned "H" marker was reported defective in pilots. One pilot telephone disconnected that the set was in working order but that the live poles supporting the antenna had been nearby several.

• **Hawaii Hughes** has placed a contract for 75 Boeing 707 jet transports it was needed in a prospectus recently filed with the Securities and Exchange Commission in connection with a Trans World Airlines stock issue (AW July 22, p. 47). The prospectus and TWA had made no commitment to purchase the planes from Hughes.

*New Cessna YH-41 delivers top performance
plus big maintenance savings*

to helicopter flying!

Cessna's all-new YH-41, recently purchased by the U. S. Army for its air arm, combines the latest in design and engineering advances to give operating and maintenance performance never before experienced in the helicopter field!

For example, the engine—mounted in the nose of the fuselage—makes installation and servicing easy—provides extra cargo or passenger space. Cessna has made the rotor assembly aerodynamically clean. Also, the drive system on the new YH-41 is a masterpiece of simplicity, has a minimum of parts—conveniently located for easy servicing.

Offering multi-utility uses, the 4-place YH-41, at 3,000 lbs. gross weight, can climb higher, faster than any other helicopter in its class—see level to 10,000 ft. in less than 12 minutes! Its speed is the fastest in the light helicopter field.

CESSNA AIRCRAFT CO., WICHITA, KANSAS



Airline Income and Expenses—May, 1957

(in dollars)

	Passenger Revenue	IFAT Revenue	Express Revenue	Freight Revenue	Total Operating Revenue	Total Operating Expenses	Net Operating Income (Before taxes)
DOMESTIC TRUNK							
American	410,113,182	509,189	\$101,117	\$7,419,195	\$48,199,914	\$46,116,116	\$1,199,999
Boeing	4,191,591	157,586	24,493	131,759	4,223,489	4,209,479	122,010
Capital	2,844,814	174,283	48,123	161,179	3,044,300	2,834,284	210,016
Continental	5,819,893	41,499	10,744	45,657	5,137,479	5,104,864	177,615
Delta	5,876,172	121,193	41,430	219,373	6,057,208	5,822,181	235,027
Eastern	19,421,461	439,706	171,474**	—	20,032,641	17,243,769	2,788,872
Midwest	5,194,119	91,569	30,701	149,264	5,196,709	4,922,467	16,242
Norfolk	2,445,228	43,779	33,723	75,628	2,538,358	2,464,111	74,247
Norfolk	4,419,716	157,264	247,194**	—	4,624,199	4,439,767	184,432
Trans World	14,254,420	208,374	891,791**	—	15,154,585	15,044,854	109,731
United	30,235,724	816,469	191,488	1,172,107	32,425,787	31,777,912	647,875
Western	9,637,191	64,719	13,197	67,334	9,782,399	9,703,764	78,635
INTERNATIONAL							
American	240,311	5,103	137	44,341	245,592	247,474	-1,882
Boeing	274,287	101,237	—	21,778	377,302	377,302	—
Continental-Africa	141,163	2,493	4,704**	—	148,360	134,121	14,239
Delta	491,793	4,548	—	14,413	506,754	477,476	29,278
Eastern	1,339,722	21,719	32,169**	—	1,393,610	1,315,174	78,436
Norfolk	—	—	—	—	—	—	—
Norfolk	1,348,799	471,483	389,799**	—	2,419,999	2,344,176	75,823
Trans World	—	—	—	—	—	—	—
United	381,100	11,300	45,100**	—	437,500	411,000	26,500
Western	2,212,100	292,000	48,100**	—	2,552,200	2,492,100	60,100
Latin America	4,387,100	191,000	1,791,000**	—	6,569,100	6,451,000	1,118,100
Pacific	4,111,100	444,000	411,000**	—	4,966,100	4,811,000	1,155,100
Panama	1,117,100	42,000	—	100,000	1,259,100	1,247,100	12,000
Trans World	4,312,100	445,000	384,779**	—	5,141,879	4,941,100	200,779
United	908,672	24,911	—	18,244	951,827	907,554	44,273
LOCAL SERVICE							
Allegany	449,323	7,219	4,769	14,820	476,131	487,921	-11,790
Boeing	118,128	1,200	1,252	2,142	122,722	124,284	-1,562
Continental	117,793	2,169	794	4,438	125,194	124,176	1,018
Delta	246,100	212,773	2,342	16,440	567,615	537,141	30,474
Eastern	—	—	—	—	—	—	—
Midwest	416,390	19,429	6,222	12,872	454,913	445,719	9,194
Norfolk	361,717	344,569	4,746	—	711,032	681,191	29,841
Norfolk	477,321	9,341	2,194	10,741	509,597	484,366	25,231
Pacific	300,349	9,343	2,114	—	311,806	286,709	25,097
Southwest	106,303	10,164	9,127	4,368	129,962	124,148	5,814
Trans World	391,379	10,479	2,713	12,811	417,382	404,109	13,273
United	216,884	4,227	1,227	4,212	226,550	215,561	10,989
HAULAGE							
Boeing	240,702	2,100	—	16,099	258,901	258,901	—
Trans World	145,984	1,149	10,842**	—	157,975	157,975	—
CARGO LINES							
American	10,634	817,711**	—	—	828,345	871,486	-43,141
Boeing	12,544	347,201**	—	—	359,745	374,346	-14,601
Continental	—	—	—	—	—	—	—
Delta	—	—	—	—	—	—	—
Eastern	—	—	—	—	—	—	—
Midwest	—	—	—	—	—	—	—
Norfolk	—	—	—	—	—	—	—
Trans World	—	—	—	—	—	—	—
United	—	—	—	—	—	—	—
WILSON							
Boeing	13,844	71,830	10,079**	—	95,753	94,191	1,562
Continental	12,709	12,334	4,637	—	29,679	31,110	-1,431
Delta	32,144	2,810	2,333	2,714	40,001	38,719	1,282
ALASKA							
Alaska Airlines	134,241	47,472	714	11,470	193,897	174,176	19,721
Alaska Airlines	17,346	26,481	—	6,720	50,547	47,472	3,075
Delta	47,119	6,442	—	5,443	59,004	52,822	6,182
Pacific Northwest	204,472	16,442	17,167**	—	238,081	231,609	6,472

* Not available

** Property lease

† System lease

Compiled by AVIATION WEEK from online reports to the Civil Aeronautics Board

AERONAUTICAL ENGINEERING



FIRST vehicle, C-400 P.1 released under gantry, is flown by remote control from ground.



ATAR VELAINT C-400 P.3 in its one and maximum platform altitude reached during the ascent program has been about 700 ft.

Flying Atar VTOL Is Simple, Promising

By David A. Anderson

Paris-Suva's Atar Velaunt, a simple VTOL test vehicle consisting of one Atar turbojet, an engine seat and four outriggers, was the technical sensation of the *21st Salon de l'Aeronautique*.

From before an open ramjet test stand by Auguste Mader, whose five-foot test pilot and control face, the "Flying Atar" stood upward to a height over 100 ft, and only through the sky to a point in front of the receiving stand, maneuvered gently and then released to its parking area above the field where it settled in a cloud of reddish dust blown from its exhaust jet.

In these brief minutes of the demonstration, Suva's first test design program with the Atar vehicle showed complete proof of the engineering feasibility of such a design. The piloted Atar test vehicle, designated C-400 P.2, a part of the stages in a multi-step program begun by the French company in 1952. Next step in the P.3, similar in

layout, but with an enclosed cabin and a sonar seat to check the character of transition from vertical to horizontal flight.

So far, a total of about 54 million has been spent on the project, divided about evenly between company funds and French Air Ministry backing. Auguste Mader, engineering boss on the project has been 15 years headed originally by the same Gertrud, technical manager.

Simplest Concept

In its present configuration, the Flying Atar is certainly the simplest VTOL now being. It consists of a standard Atar D turbojet rated at 2,500 hp (about 6,000 ft-lb) modified to operate vertically, a light cylindrical housing containing fuel and oxygen, four outriggers which are the landing gear and which also support four bleed air jets for roll control, the necessary pilot's controls and a few obsolete engine test beds by Sud Aviation.

Total weight of the complete vehicle is 2,600 kg, about 5,700 lb.

Of which almost one-half is fuel. Even so, side flight duration is limited to a little more than four minutes.

Heart of the system is the pneumatic thrust deflector developed by Suva. This is the principle also known as the "jet pump" because it uses air injected at right angles to the main exhaust stream to deflect that stream locally to form a nozzle. Normally this is used as a temporary ring around the exhaust jet so that the deflection produces an easily controlled nozzle. But for the Flying Atar, the bleed jet—using hot air taken from the combustion chamber coming in separated into four quadrants which can be opened singly or in combination to produce an angular instead of deflection of the jet.

Such deflection produces an air cloud thrust vector which guides the Atar from its vertical flight path and starts the transitional motion of the vehicle.

In Equilibrium

Once the motor has been started and the vehicle is tilted from the vertical, it is in equilibrium and will not move to move, in a horizontal direction until the controls are reversed and the thrust axis is tilted in the opposite direction.

Roll control is obtained by paired jets along an axis from the front of the engine compressor. These jets are supported by the oxygen leading pipe and discharge just outside of the outriggers.

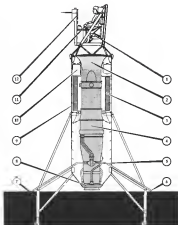
Stabilization of the Flying Atar is performed by an autopilot using signals from a combined system of attitude and rate gages. The first measure the vehicle's attitude and the second its deflection rate.

Overall height of the P.3 is about 25 ft. The complete nacelle is approximately 20 ft high and just under 10 ft in diameter.

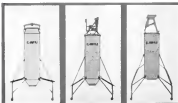
The pilot sits in the head-to-tail section seat manufactured by Sud Aviation. He faces an array of flight instruments mounted in the shape of the Greek letter Pi. At his left is a conventional control stick and between his knees is a yoke mounting a horizontal control stick on the top. This stick operates the electrical signal system that controls the jet deflection.

Because of the low thrust-to-weight ratio of the Atar Velaunt—approximately 1:1 at takeoff and increasing during flight as fuel is burned to a maximum approaching 1:1—control of the vehicle is a sensitive process and requires a light hand on the throttle. Coupled with this is the added sensitivity of the vehicle in response because dropping and rising are both very low.

A further complication in flying the Atar is that as the angle of inclination increases, the vertical component of the



SECTION through Atar C-400 P.3 shows design features of the simple VTOL unit: (1) fuel injection system seat; (2) forward bleed-air inlet for engine; (3) fuel tank with a capacity of 775 gal.; (4) Atar DV turbojet; (5) moving valve for roll control jets; (6) roll control jets; (7) nitrogen leading pipe; (8) air intake for roll deflection; (9) nacelle structure; (10) stabilization system; (11) pilot's controls; (12) instrument yoke.



PROGRESSIVE steps in the test program: C-400 P.1 (left), unpowered sub-controlled vehicle; P.2 (center), powered machine carrying flying P.3 (right), basically the same as other units but with a ground-mounted seat and controls, enclosed cabin.

Tested and Approved by the British Royal Aircraft Establishment



KEARFOTT TYPE 9790
Illustrates 2 1/2" dia. x 3-5/8" long
Weight 2.5 pounds.

CHARACTERISTICS

Global Precision	± 2"
Angular Movement	± 0.05 x 10° Gal./Sec.
Turn Sensitivity	1.5 degrees
Drift Rate	± 0.02% 1/2 hr. drift of direction from straight line
	10°/hr. maximum speed
Axis (tolerance)	± 0.001 in. dia.
Temperature Control	± 0.1°
Power Required	20 watts
Motor Starting	125 Watts
Running	4 Watts
Alt. CR	0.11X, 400 cps, 3 phase
Alt. CR	0.11X, 400 cps, single phase
Turn	0.02 in. dia. 100 cps
Speed	0.02 in. dia. 100 cps

After an exhaustive test program conducted at the Royal Aircraft Establishment, Farnborough, England, the Ministry of Supply selected a Kearfott floated rate integrating gyro for a major defense program in Britain. This gyro is the Kearfott Model T2542 which represents the most precise production gyro available today.

Does not require daily trimming nor compensation. Suitable for manual guidance or any application which demands the day-to-day precision inherent in this gyro.

This floated rate integrating gyro is hermetically sealed for complete protection in any environment and to permit operation at extreme altitudes. The input axis is located by an indexing notch in the mounting flange. The values tabulated represent the day-to-day characteristic of this gyro.

KEARFOTT COMPANY, INC.
Late Feb., N.Y.

Sales and Engineering Offices: 4100 Main Avenue, Chiles, N.Y.
New York Office: 45 W. 42nd Street, New York, N.Y.
Sole's General Office: 111 Deane Drive, Dallas, Texas
West Coast Office: 111 N. Main Street, Pasadena, Calif.



A DIVISION OF
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mounting on a specially built test stand and put through a complete program of thrust and attack variations. Aerial fuel was added here so that the running time of the test could be as long as desired.

This was the last stage in the development of a sustained test vehicle. The Alt used in the first engine stand was then converted so that it became the first of the two flight test vehicles, the converted C-460 P-1. Radio controlled and refueled in the past by five relay cables, this vehicle started its flight tests in 1956 and has made more than 150 tethered flights since. Flight time on this vehicle has been limited to a maximum of about seven minutes per test because of the fuel limitation.

Manned Vehicle

During the development testing of the P-1, engineers were designing and fabricating new hardware for the P-1, a manned piloted version of the P-1 test vehicle. When the P-1 had a single engine inlet screen, the P-2 required a two-stage, frame holding an engine inlet and pilot's controls.

The P-2 was to be flown first in tethered flights and later in free flights. In March, the P-2 had begun flying. In 1955 from its ground trailer and at the end of February 1957 made the first P-2 flight.

By March 6 the P-2 was ready for its down tests to check the system operation. Between then and March 10 about 50 tests were made with the P-2 sustained free flight.

March 30 March ended the P-2 of the ground under the shadow of the center for the first manned tethered flight, beginning the final check of the observation system preliminary to free flight.

Finally on May 14 March climbed the twenty steps of the mobile maintenance platform, period alongside the Van Volant. When the fuel pump of the ground tank wheel is closed and the tank pulled away. The Alt mounted, sustained and then moved into the Alt used through the starting sequence.

Free Flight

Then the Alt released moved up wind. The shock absorber on the outrig gear (impeller) and March was under way on his first free flight. Balanced on the hovering engine, the P-1 moved up wind and climbed slowly as March gently advanced the throttle and felt the sensitive response of the vehicle.

While the P-2 test program moves along, work is entering completion on the P-3 test vehicle. Because the P-3 will be an enclosed cabin, primary purpose of the vehicle of the Flying Alt.

FASTENER PROBLEM



Leakproof self-locking fasteners for integral fuel tanks

Aircraft designers have eyed the space-saving possibilities of "Wet Wing" or integral fuel tanks for some time. But... the "wet" action of the wing must be balanced in such a way that highly volatile materials back will not leak under the heat of the tank burners or seep out along their bolt heads.

ESMA has just developed the first completely patented answer to this problem. The new ESMA type A2506 floating anchor cap nut (see diagram) is a self locking anchor nut with no "O"-ring and in its base. In tests, the nut has sustained a perfect seal against pressures above 50 psi on either side, regardless of structural stress, vibration, or temperature changes. The seal is effective whether the bolt is installed or not. It is not destroyed by repeated bolt installation.

The type A2506 is the lightest nut of its type, 180 nuts weigh only 1.2 pounds. It meets AN-3 specifications for operation between -80° F. and +250° F. and can be used for extension bolts and those built by varying its component materials such as the "O"-ring. It provides 450 inch maximum floating action allowing quick assembly in spite of slight misalignment of bolt holes. The A2506 is 100% and tested prior to shipment. The basic design has been approved by the USAF. Size range from 1/8" through 1 1/2" dia., 5/16-24, 5/8-24, and 7/16-20.



A girth chain strip providing a series of regularly spaced A2506 nuts has been designed.

The new Boeing 707 Jet Transport is among the first aircraft equipped with integral wing fuel tanks. It has used the new ESMA type A2506 locknut nut.

MAIL THE COUPON FOR DESIGN INFORMATION



Shenck Shop Hat Corporation of America
Dept. N70-455, 5545 Van Ness Blvd., Union, New Jersey

Please send me the following information (no return):

- ☐ Details on A2506 nut
☐ ESMAE 500P and 500L

- ☐ Details on A2506 nut installed
on wing and on up

Name

Title

Co.

Street

City

State

Date

Year

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Let Atlas help you in your program. We've been "precisionizing" on a contract basis for more than a quarter of a century. May we work for you? Write us with your production and design problems... get your copy of the booklet "Precisionizing Electro-Mechanical Equipment" Atlas Precision Products Co., Philadelphia 24, Pa. (Division of Production Industries).

"From Drawing Board... to Production Line"

ATLAS

Precision Products



to check the design of the rotating unit developed in part of the overall vehicle program. The flight test program of the P-5 will be limited to near vertical attitudes only, because the Atlas has no aerodynamic lifting surfaces and does not have enough power and control to tilt safely more than 15 deg from the vertical.

But the P-5 is also scheduled to go into the test stand that completed the program of the P-1, where these design of features can be given to the engine. The whole vehicle will be "flown" through a simulated program from vertical launch through transition to and from horizontal flight and back down to a vertical landing.

What comes after the P-5? Because it's using much, it does hope the flight tests will make enough interest to get a VTOL aircraft project started somewhere in the French or foreign industry. Its own contract in such aircraft centers around the helicopter concept patented by Von Zierow, whose study bureau has been turning out drawings and models of everything imaginable from bomb-like shells to transport, all bearing the hallmarks of the vertical wing.

Fights to the Von Zierow patents have been bought by Sorensen. There has been engineering liaison between the two concerns, although there is at present no direct connection other than the patents rights agreement.

Part of the Atlas Volex's future is tied up in the success of the test program, which as far has been going smoothly. But by the time the bigger part of its future depends directly on that of the entire French aircraft industry. Technically healthy, the French is driven to technical by the severe economic difficulties that face the country as a whole.

If France pulls out of its current slump, lifting the hopes of the aircraft industry with it, then there is a future for the Atlas Volex. If the financial situation forces further postponing of the aircraft companies and further economic in the country's military program, then the chances are good that the Atlas will join many other promising French aircraft designs in a limbo of lost opportunities.

C-130 Makes Two Engine Transcontinental Flight

Lockheed C-130 Hercules transport flew nonstop from Eglin AFB, Fla., to Norton AFB, Calif., on two engines in a test mission.

Two of the airplane's four Allison T55 engines were shut down to determine engine's limited power capabilities. Flight brought many reports from observers that plane was in trouble.

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TBT designs required by JT3 and JT4 engines include both, rods, pistons,

CAA Sets Rigid Standards for Certifying JT3, JT4 Engines

Civil Aeronautics Administration certification of Pratt and Whitney's JT3 and JT4 commercial turbojet engines involved a test program with some 10 specimens never encountered in checking out piston engines in the past. The manufacturer recently reported CAA participation in September 1974, and both engines received their certification last March. JT3 is [JT3] JT4 the JT3.

Requirements included:

- Necessary data is not available for 150 hr. at maximum loads.
- Fuel system to check, not only 500, 1000, 1500, 2000, 2500, 3000, 3500, 4000, 4500, 5000, 5500, 6000, 6500, 7000, 7500, 8000, 8500, 9000, 9500, 10000, 10500, 11000, 11500, 12000, 12500, 13000, 13500, 14000, 14500, 15000, 15500, 16000, 16500, 17000, 17500, 18000, 18500, 19000, 19500, 20000, 20500, 21000, 21500, 22000, 22500, 23000, 23500, 24000, 24500, 25000, 25500, 26000, 26500, 27000, 27500, 28000, 28500, 29000, 29500, 30000, 30500, 31000, 31500, 32000, 32500, 33000, 33500, 34000, 34500, 35000, 35500, 36000, 36500, 37000, 37500, 38000, 38500, 39000, 39500, 40000, 40500, 41000, 41500, 42000, 42500, 43000, 43500, 44000, 44500, 45000, 45500, 46000, 46500, 47000, 47500, 48000, 48500, 49000, 49500, 50000, 50500, 51000, 51500, 52000, 52500, 53000, 53500, 54000, 54500, 55000, 55500, 56000, 56500, 57000, 57500, 58000, 58500, 59000, 59500, 60000, 60500, 61000, 61500, 62000, 62500, 63000, 63500, 64000, 64500, 65000, 65500, 66000, 66500, 67000, 67500, 68000, 68500, 69000, 69500, 70000, 70500, 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Sabreliner Engines Are Relocated

Engines of North American Sabreliners, originally based in wing root (AW July 1, p. 12), have been relocated in pods on aft fuselage. North American says change was made solely to gain a desired wing configuration for the aircraft, which was designed to comply (except to meet a USARF requirement) for an all the (left) transport and some evidence. New design is similar to Lockheed C-129 which has four engines podded on aft fuselage and to the Sud Aviation Caravelle conventional transport. Lockheed engine also was designed to meet same general requirement.

Bristol Pushes Gear Changes To Meet Northeast Schedule

London—Despite growing tension in Britain over what have been called "very, very silly" requirements of the U. S. Civil Aeronautics Administration, Bristol Aircraft Ltd. is pushing ahead with required landing gear modifications of the upcoming Britannia to meet delivery schedules to Northeast Airlines.

Bristol is taking the attitude that "the CAA requirements exist and if we want to sell aircraft in the U. S., we will have to meet them." Although there have been reports to the contrary, the firm says it will deliver the Northeast Britannia in time for the airline to meet its two vacation schedules to Miami.

Lord Brittain, chairman of Britain's Air Registration Board, stated up considerable today when he declared recently that relations with the CAA and Civil Aeronautics Board are now too friendly.

"We in these islands, and especially in the ARB, believe that our British standards of airworthiness are good," he said, "but we are quite prepared to respect the standards of other countries

and we certainly respect those of the United States. But we expect them to accept ours. We do not want to see a battle of special requirements, because some of the special requirements are very, very silly."

Won't Argue

Bristol may feel that some of the CAA requirements, it has to meet out of duty, but the company is taking the stand that its job is to meet the requirements not to argue about them.

There is no question that the CAA landing gear requirement for the Britannia's basic gear, and the related maintenance was meeting the requirement, were granted with little enthusiasm at the Bristol plant. But the firm's attitude is that what would have been a considerably greater enhancement.

Earlier this month, at the same time Bristol engineers were pushing through a redesign to strengthen the gear to meet CAA requirements, landing gear of a Britannia stopped while the aircraft was under test at Weybridge, B. C.

Pertinent CAA requirements call for ability of the aircraft to pivot on the center of its undercarriage. The Britannia, which employs bogie gear, is not designed for such pivoting. To satisfy requirements of Britain's CAA, Bristol has declared a 15 ft. turning circle for the Britannia 100 and a 20 ft. circle for the Britannia 160 and provides what it considers adequate strength to meet those requirements.

CAA has insisted on a pivoting ease which will give 2.7 times the load of the previous torque case and has asked for modifications on the braking rod and the springback case for the radius rod.

Major Change

The landing gear changes are the major modification to two which the CAA has asked for in the Britannia. They will mean a total undercarriage weight increase of about 100 lb. per aircraft.

There is a 10-day limit on the nose steering of the Britannia to avoid excess stress on the main gear. There is a warning indicator on the nose wheel as well as a warning horn which sounds if the limit is exceeded.

In the Canadian accident, the Britannia was being tested in Britain at 3



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says Captain Eddie Rickenbacker, President, Eastern Airlines

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with two Douglas DC-8s being run up alongside. Operator of the tug declined to tell how the warning horn became at the cause of the other accident.

A winner of the main gear of the Britannia 104 stopped and the company was forced to fit a new leg but before the aircraft could make its return flight to England.

CAA's leading gear strength requirement has existed for some years. But when the question was not raised in two versions with CAA representatives last year, Bristol assumed the requirement was not applicable to the Britannia's large gear.

Question Unrevised

On July 4 of this year the company was informed by letter it would be expected to comply with the requirement. This was the list of the CAA requirements to be laid down for the Britannia and is the major structural modification. Only other structural modification called for was strengthening of control surface hinges, according to the manufacturer.

To meet CAA specifications, Bristol is providing the Britannia with a slightly heavier top winging with large increase in the material around the wing box. New bottom end fittings also are required, as well as a new large winging with more material around the pivot pins.

Sections themselves have been changed from light alloy to steel and increased in weight from 9 lb. each to 13 lb. Since there are four sections per aircraft, this means a weight increase on the section alone from 36 lb. to 52 lb.

Although not so severe as Northwest's quarter wing 105, the total undercarriage weight increase of 350 lb. can be a considerable penalty on the large-range version of the Britannia.

Time Stress

Critical point moment is the need for a heavier bottom steel fitting. This is a complex fitting. "When you have to call for a new fitting like this one, you're really up against it," a Bristol engineer said.

A month was spent on redesign of the joint. The time spent has been longer if Bristol engineers had not already been studying heavier gear in looking ahead to Britannia's higher gross weights. The heavier fitting, for example, already had been designed for larger aircraft.

Britannia undercarriage is built by Bristol Motor Ltd.

Bristol plans to deliver Northwest's last Britannia in November with a "final" undercarriage. The second and final order is to be delivered to Northwest in the first half of December.



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Chop weight, get thinner sections with Alcoa high-strength castings

Reduced weight and higher strength are now casting realities. Thinner sections, lighter parts are now possible. Castings can be turned to new limits. Alcoa's new high-strength process guarantees you high properties.

Formerly, the properties of a casting were based on separately cast test bars. In design and application, a casting factor had to be applied to reduce these properties. With Alcoa's new high-strength casting, mechanical properties are based on bars cast right from the casting itself. No reducing

necessary. And, best of all, the guaranteed properties are in all the castings in the run... consistent, consistent. Mechanical properties in castings for strength structural parts.

New carefully controlled foundry practice and improved alloys are the developments responsible. The alloys are A356 and C355. These are the same composition and meet specifications for tensile strength 356 and 355, with one difference. Improvements are embodied in a new treatment, iron content, for example, is held to

0.05% in the improved alloys. Such seemingly minor changes make a whole lot of difference.

Extremely careful control in all steps of the foundry process, plus several new Alcoa developments in aluminum foundry techniques, is also vital in making these high-strength castings.

High-strength castings can be made in sand or plaster molds... sometimes in permanent molds. Alcoa's standard guarantee of properties for alloy A356-T6 is 39,000 psi tensile, 20,000 psi yield, and 25% elongation. Occasionally, because of complex shapes and designs, high strength can be furnished only in certain areas of the casting. But, by working closely with the designer, Alcoa can usually give the look strength right where it's needed.

Your Alcoa sales engineer has the facts on this new process. Let him work with you in obtaining castings with high properties—properties that don't have to be reduced in application. Aluminum Company of America, 3320 11 Alcoa Building, Pittsburgh 29, Pennsylvania.



Important multiple structural castings for Douglas. Alcoa's high-strength casting process and alloy A356-T6 give them some of the desired properties even cast. Here are the properties obtained in test bars cast from the castings.

	Tensile, ksi	Yield, ksi	Elongation, %
Prime Casting			
Airframe	42.1	33.0	10.0
Structural	44.4	34.3	11.8
Structural—Brazed production runs	40.1		
Block Casting			
Airframe	48.1	34.3	10.0
Structural	48.1	34.3	11.8
Structural—Brazed production runs	40.1		
Minimum Required	40.0	30.0	10.0



Your Guide to the Best in Aluminum Sales

will have "American" leading gear. The first of these two will cut across the Atlantic in new undercarriage due to the first airplane.

Remaining two aircraft of the North east order are to be delivered in January and February.

The aircraft are being modified in CAA and No. 10000 requirements at Bristol's main plant at Filton after being flown over in stripped condition from the Short Bros and Harland plant at Belfast, Ireland.

Delivery of the first aircraft with unmodified undercarriage is expected to enable Northair to go ahead with construction without waiting for completion of the modifications.

Merger Is Discussed By General Dynamics

General Dynamics Corp. and Liquid Carbonic Corp. are discussing a merger which, if completed, would create two corporate giants with strong research and product resources.

In a joint statement issued last week by the two firms, Frank P. Taylor, Jr., General Dynamics president, and his company's president is to develop the tremendous potential of the aerospace, electronics, hydrodynamic, electronic and nuclear technologies.

"A logical extension, therefore, of the corporation's activities is an entry into the chemical field, especially with respect to compressed and liquid gases which are extensively interrelated with rockets, aircraft, applications of nuclear energy, and electronics," Pater said.

Ron L. Nashelson, Liquid Carbonic president, said his firm believes the merger would permit Liquid Carbonic to attain more rapidly and probably in objectives of expanded activity.

Lockheed to Build Light Jet at Marietta

Lockheed Aircraft Corp. transferred manufacture and sales of its four- to two engine jet utility transport, the UCX (Model 315) (AW July 1 p. 82) to its Marietta, Ga. facility. In addition, Comptech Division sales staff is aggressively pushing orders applications for the C-130 helicopter transport.

One-Man Helicopter Flight Tests to Begin

Chinook Helicopters, Manhattan Beach, Calif., plans first flight test soon on one-man, strap-on helicopter development contract with private capital.

Single Model helicopter will jet gas pulsation and lightweight, inexpensive fuel for structure.

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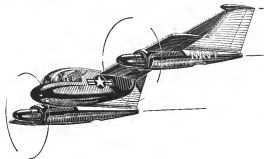


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F-105 HAS FLAPS down and leading edges drooped for landing. Droop is also used at cruise to give benefits of control surfaces.

F-105 Shows Steep Climb, Weapons Load



Republic's F-105 Thunderchief fighter-bomber, unveiled at the Golden Anniversary Air Show sponsored by the Air Force Association at Andrews AFB, Md., is designed to carry a large weapons load either externally or internally in a bay with doors that slide upward into the fuselage.

One of the features of the inlet, not clearly demonstrable in these first pictures of the airplane, are movable wedges actuated by hydraulically controlled arms. They are inside the inlet on the outer portion toward the wing tips. An NACA development, the wedges are controlled by a system built by Lear.

Displayed on display at Andrews was the third F-105B, powered by a Pratt & Whitney JT75-P1 engine and equipped with 51 inches worth of test equipment. After the show it was flown to Edwards AFB, Calif., with three fuel tanks on board, where it will be re-equipped with a JT75-P5 engine that will go into F-105B production airplanes.

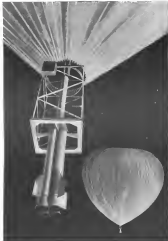
This is an advanced version with two lower compressor stages and lower compression ratio.

F-105 has lateral control surfaces on top of wings. Four petal camber breakers on last three feet of tail were described by pilot as giving good landing control without trim changes. They are used slightly open for landing.

It is an ejection. Retractable probe on left side of nose in front of wind sensor.



WEAPONS load of F-105 is part of fighter-bomber configuration. Aperture in nose is for machine gun.



BALLOON at 100,000 ft. hovering altitude is inflated to full diameter of 200 ft. (left above). At hovering, Farside vehicle is fixed vertically through apex of the balloon (right). At start of first stage rocket engine is completed, second stage engine is ignited. Vehicle includes four rocket stages, 14 lb. instrument package.

Farside Rocket to Fire Through Balloon

Rocket to be used in Project Farside high-altitude tests later this year (ENR July 27, p. 15) will blast upward through the balloon which is expected to carry it 4,000 mi. off the earth. Initial first-stage thrust of the vehicle will approximate 160,000 lb.

The 6 x 4 in. instrument package payload of the rocket will weigh 14 lb. It will be dropped to subsonic a maneuver acceleration of 200Gs during its 5 sec. of powered flight.

Vehicle Weight

Vehicle itself will gross about 1,900 lb.

Farside program is sponsored by

USAF's Office of Scientific Research, Aerometric Sciences, Inc., a Ford Motor Co. subsidiary, is the prime contractor. Purpose of the project is to gain research data in an environment outside 90% of the earth's atmosphere.

Flight tests with a balloon designed for Farside use were carried out last month at the General Mills Flight Test Center near New Brighton, Minn. The General Mills-built 1,778,000-cu-ft. balloon reached 100,000 ft. during its flight, automatically releasing its contents shortly after 15 hours. The instrument package parachuted safely to the ground near Buffalo, Minn.

During the actual Farside tests, a

specifically developed transmitter will send back measurement of cosmic rays and information on the earth's magnetic and gravitational fields, geomagnetic storm effects, ionospheric measurements, meteorite densities, and the like.

Four Stages

A cluster of four Thiokol Chemical Corp. Aerocast rockets makes up the first stage of the vehicle. A single Aerocast makes up the second stage. Third stage disintegrates from Aerocast rocket engine, and the fourth stage is a single Aerocast II with instrument package attached.

Present plan calls for a total of six



PRE-LAUNCH operation enables payload of 1,770 lb. 4-in. polyethylene balloon. Farside vehicle and launcher are attached to balloon's air-lead ring. Balloon is continuously inflated to reach required altitude.

flight tests at the Pacific Proving Grounds during the latter part of September.

Description and optical tele-sensing will be covered by the Air Force's photographic center, Lockheed Mt. Laboratories.

Aerometric will evaluate the data received after completion of the test program.

Geostatic History

Office of Scientific Research in November, 1956 awarded to Aerometric a contract to investigate the feasibility

of developing a vehicle capable of carrying instruments to a height of several thousand miles.

The feasibility study was completed in early 1957, and Aerometric then received a contract to build the vehicle.

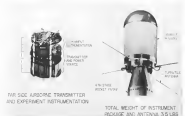
This contract also provided for the flight testing of the vehicle this fall. Besides Thiokol, General Mills and General Mills is subcontractor on the project, Paul S. Ford, Surgeon of the University of Maryland is performing work in connection with the cosmic ray experiment with the project.

Static tests of the rocket engines and

flow associated systems are now under way at Thiokol's facilities at Elkhart, Ind., and at General Mills' Montrose, Colo., facilities. Part of the flight test vehicles has been assembled by Aerometric at Glendale.

Further payload assembly and operational tests will be performed on each vehicle prior to shipment to the Pacific area.

Ground moving and mounting equipment will be brought from Aerometric facilities at Glendale, Calif. It will be erected and checked out at the Pacific site.



INSTRUMENTATION of Farside vehicle includes speed sensitive accelerometer. Transmitter antenna, which will open at end of launch sequence, is shown extended.



CLUSTER of first stage rocket engines is examined by H. L. March, project director.



Planting trout by air into Cascade lakes

"Bombing" mountain lakes with fingerling trout, Sam Whitney has revolutionized Oregon's fish stocking program. In just one month he "plants" more than 350 lakes by flying 150 feet above the water—high enough for the fish to lose their forward motion before they hit. Truck crews previously spent all summer stocking only 60 lakes. "Dropping trout over those small lakes in timber country can be a lot of fun," says Mr. Whitney. "So long as I know I have enough power to get up and out again. That's why

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TIP OF THE MONTH

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FIRING of Matador TM-61C missiles across arch of the Libyan desert in front of 70th Tactical Missile Wing's training program

Matador Wing Training Based on Firing

By Chuck Witte

Whether AFM, Libya—Training program of the 70th Tactical Missile Wing includes the firing of 36 Matador TM-61C Matadors each year from a site 15 miles east of the base on the southern Mediterranean shore. The 70th is part of the 12th Air Force of USAF (Hq. in Air Force Europe).

Curiously, the 70th's three groups from the TM-61A to the TM-61C was completed at the home base in Germany early this year. There will be another shipment in the future, to the TM-61B.

The B version will bring a bigger jump in performance and reliability. It is larger than its 79th predecessor and has a shorter wing span. Possibly the speed will be greater than that of the A and C models—more than 600 mph. Getting in more than 35,000 ft

altitude of the Libyan desert, where missiles and cruise were tested in advance of the 70th's activation to fire. Over the short a even there is a race among the nations to find the missile and salvage the missile.

Even at the launching pad, Libya police patrol the area to keep local scavengers from fighting over the NATO (nuclear assisted) missile launchers that drop from the Matador 600 to 800 miles in front of the launcher. The NATO pays 12,000 lb of threat for two missiles.

Training Program

Col Robert Zadenko, deputy commander of the 70th, places emphasis on the fact that the missile is not at all of its own doing for the AMLO (airborne missile launching operation) to come along. There is a continuous training program in Germany and the launch unit has taken part in a large number of NATO, USAF and wing exercises.

The TM-61C carries both MSQ (missile seeker) and Shrike guidance systems each of them requiring ground stations.

France sends a communication to FM/USAF radio, with all of the equipment mounted on one for mobility in the field. Wire circuits or landlines are secondary. They give better communication but would not be degraded in an event of war. A third method of communication is HF radio.

These circuits provide the unit with point-to-point and communication and relay to missile operations center and MSQ guidance unit. Other have to the groups to the wing for overall control.

All of the equipment at the Wiesbaden test was brought here from Germany in C-119 or C-114 aircraft, unloaded at the transport vehicle and then moved to the launcher. The missile was shipped in four steel containers and one wooden crate, weighing 2,745 lb of it of space, 20,000 lb.

Controllers of the 70th are trained in Germany with Lockheed T-33 jet containing the same kind of guidance system used in the Matador. During these simulated missile flights there is no communication between the pilot and ground crew. All controlling is done by visual and radio signals.

The pilot knows if he is on or off the path by both a beep signal as the missile and laser beam he releases light on the instrument panel. The ground controller is fully responsible for guiding the pilot correctly to the target point.

Missile Run

There is a network of guidance stations in Germany and each T-33 is capable of performing two or three simulated missile runs on each sortie. The 70th is composed of three Tactical Missile Groups. There are the 55th TMG at Bielefeld, the 58th

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TMG at Sumbak, all losses in Germany.

Each group has three squadrons: a Tactical Missile Squadron, a Communications and Guidance Squadron and a Support Squadron to take care of the transportation. Each squadron has 12 launch teams and each team gets one opportunity each year to launch a missile at the Wierles range.

According to Col. Zacharias, the team training program in both Germany and Libya is going on at top proficiency. USAFET already is preparing for the 1961 test combat exercises. During the Hungarian crisis of last November the squadrons were put on 24-hour alert and the control sites were alerted around the clock.

Instability Plagues 17th Air Force Area

Wheeler AFB, Libya—The Mediterranean is an ocean completely surrounded by the 17th Air Force.

With responsibilities that range from Northern Italy to North Africa and from Mexico to Turkey, the 17th covers a territory bigger than the United States. And it is an area plagued by political instability and economic scarcity.

There are the struggles for independence in Morocco, Tunisia and Algeria, the Suez situation, the tensions around Israel and the tangle of Cyprus.

From 17th Air Force headquarters here at Wheeler, these dangers are complications that put around difficulties in the way of operations, threatening the security of installations and personnel.

Major Gen. Richard J. O'Keefe, commander of the 17th, probably is USAF's greatest expert on Arab affairs and he stresses the fact that he does not lend a competing or occupational factor. The 17th, he says, is an involved post.

The sheer mass of USAM's activities in this part of the world makes communications and logistics almost a most important part of General O'Keefe's job these days. He delivers about 50% of the USAF's officers and 40% of the airman in the 17th's area are accompanied by their families. There are 1,380 high school and elementary school students attending base schools.

Yet with thousands of American women and children here in addition to USAM personnel, there has been only one USAF growth that can be tied to the local economy. That was a rise of civilian aircraft.

Magnitude of the communications problem is pointed up by statistics. When the 17th was activated in 1953 it was the youngest Air Force—its entire area located from Washington, D.C. to Brooklyn, N. Y., and 93% of these

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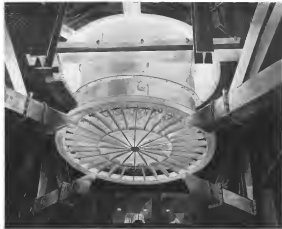
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Solar Advanced Technology

All-metal honeycomb sandwiches solve aircraft heat, weight problems



Aluminum and stainless steels combine to solve the heat-weight problem with all-metal honeycomb sandwiches. The new product—called Solair®—is a strong, lightweight structure of lock-like members bonded between metal skins.

Lower unit electric fans are designed by Solar to house these sandwich structures. Capable of operating at high

temperatures with extreme purity of atmosphere, the fans are designed to solve the heat-weight problem with all-metal honeycomb sandwiches.

The new product—called Solair®—is a strong, lightweight structure of lock-like members bonded between metal skins.

Lower unit electric fans are designed by Solar to house these sandwich structures. Capable of operating at high

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in Italy. The need to satisfy USAF needs amounted to a major accomplishment in communications engineering. The microwave network is finished and operating.

This network is vital to survival for more than the spots where U.S. units are physically located. They are in only five countries: Morocco, Libya, Italy, Greece and Turkey. But the Air Logistics Systems operates over a wider range, with Baghdad, Beirut and Jeddah in focus in our plots in LaGrande and Washington National as the planes come back home.

Radioactivity Used To Recover Rocket

Radioactive source—either two tubes of Cobalt 60 or four tubes of Antimony 124—is used in an Atmospheric Development Corp. hypersonic test vehicle to locate the vehicle for recovery after test flights.

Technique, developed by the Aero Engineering Corp. of Santa Monica, Calif., is described as relatively simple and inexpensive. It has reduced previous three-hour square search of a 16 sq. mi. area by light aircraft or helicopter to an average of 10 min.

In a typical test operation, the radioactive source is removed from its protective lead shield 10 min. before launching. Source is contained in an Allen screw one inch long and 3/4 in. diameter and weighing one or two ounces. Six foot aluminum rod fitted with suspended Allen wrench is used to place source in the vehicle.

Simplest part of vehicle is seldom cleared search for radioactivity, but area is generally known within a square ten miles to a mile. Using scintillation, aircraft search the area by flying parallel grid lines 1,000 ft apart and scintillation detector the radioactivity source.

Once located, the area is marked with firm and recovery crew picks up source in trailer containing the lead shield. Cobalt 60, with a half life of 5.2 years and an effective lifetime of 20 years, was the first source used. Antimony 124, with a half life of 60 days and lifetime of eight months, was introduced to reduce burned shield a vehicle cover be found.

Several of the vehicles in more than 40 test flights broke up in flight, but in every case the radioactive source and instrument package was located. In spite of the radioactive source is not affected by high shocks of high accelerations encountered in flight. Its weight does not affect performance and the source does not affect avionics equipment or for short periods of exposure, ordinary photographic film.

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Mechanical Drives Compete for Air Use

By Robert Conahan

New York—Air Force and Navy are encouraging development of mechanical constant speed drives for aircraft alternators in both air and variants of hydro-mechanical and pneumatic systems.

Specifically the services are watching with interest:

- **Locking mechanical principle drive**, now freely supported by Navy funds, Navy experts encouraging results from performance of a prototype.
- **Anchut Division, U.S. Industries**, mechanical drive sponsored by USAF.
- **Hamilton Standard's** mechanical drive which the United Aircraft Corp. Division is developing independently at its St. Petersburg, Fla., research and development facility.

Mechanical Virtues

Advantage of mechanical drive versus hydraulic and pneumatic types is that mechanical drives offer higher transmission efficiencies over the hydro-drive drive than hydraulic drives as well offer over pneumatic drives. Joe R. Toth, alternate drive section, Navy Bureau, and that mechanical drives achieve transmission efficiencies up to 91.95% at peak loads and maintain 92% efficiencies at half loads.

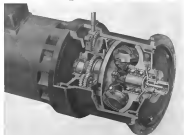
Hydraulic drives now have peak load efficiencies in the order of 85% but their efficiencies fall to 75% at half load.

Another advantage of the mechanical drive, Toth said, is that it provides about the steepest type of link between the large rotating mass of the aircraft engine and the generator. For this reason it avoids effects of sudden changes in electrical loads better than the other types of drives. A possible disadvantage could be equal progressive failure in certain cases.

Locking's mechanical drive has proved well suited among the defense industry, Toth said. "This could be due to the fact that Locking has already completed an analytical MIL-T-7101A qualification test."

For its part, Locking claims its present 20 hp. mechanical drive is smaller in size, lighter in weight than any other available mechanical hydrokinetic or hydraulic drive with comparable speed flexibility. It claims that the efficiency will be 91.95% over the full operating range.

Arthur Nats, vice president-engineering, Locking, told Aviation Week that because the contact loadings used



LYCOMING mechanical drive takes variable engine speed in air and turns it into constant speed to drive the alternator, left. The 20 hp. unit weighs 30 lb.

in the drive are less than those normally used in bearings, the ample mechanical approach should result in improved reliability. This is an important element in any alternative drive since alternative power systems are being called upon to supply an increasingly critical portion of aircraft "secondary" power.

After development and testing costs are amortized the new drive might also prove less expensive, Nats added.

Known Principles

All three of the new mechanical drives are based upon principles which have been well known for over fifty years.

Basically they are devices that vary the diameter of the speed-adjusting shaft linkage. The Anchut drive uses a conical cone and roller arrangement, the Locking drive uses eccentric rollers which between two special shaped disks and the Hamilton Standard drive is based upon the Swiss patent upon which New Departure based its Transmex automotive transmission (AV May 6, p. 27).

The reason that these principles have not been previously applied to constant speed aircraft alternator drives in the past, though they have been used industrially, is that for aircraft the demand materials and finishes which

were unobtainable. It was not until present high temperature, stretched disks were available that the known principles could be refined and packaged into an aircraft drive.

The C-D-S (constant output speed) drive, as Locking calls its product, uses the intermediate roller which to take power off one diameter (and force it at true speed) off the input side and transfer it to another diameter (and speed) on the output side, according to their angle. Displaced or bowed grooves are scraped out of each disk to take the wheel so that the drive constant forces are counterbalanced radially and there is no tendency for the wheels to be forced out away from the disks.

The input and output disks each are carried on their own bearings on a short shaft, a special hardened belt through the means of which change the two disks in speed the roller which Locking says that the disks are purposely given their own movements so that drive loads will not be transmitted to the bearing. This also eliminates misalignment problems due to thermal expansion.

The thing of the drive wheels is accomplished by the dynamic motions inherent in the spinning roller wheels as the road uses rather than plan mechanisms here.

A sag just inside the bearing has



Dear Susan:

Our good friends at Southwest Airlines have a party rule! on ever at Love Field in Dallas — a big birthday party — so, sweetie, we want you to know 'we are of these wonderful heavier-than-air cakes of yours, put twenty-five thousand candles on it (they were look older than that), and told your pretty little self over there with it. Well 'we it's from the boys at Bendix and that we wish 'em an even better success so we've sent them enjoy up to you.

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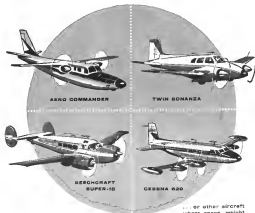
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combined with the present 3000 hp level operating torque capability of the Licensing drive help to explain the Navy's enthusiasm, Teth said. While the operation of most modern hydraulic drives is severely restricted above 3000 RPM, Licensing is confident that it can push its mechanical drive to 5007.

The initial use of the Licensing drive is 70 lbs. Future drives will be as big as 120 lbs. The 26 lbs drive will weigh just over 30 lb.

The Acheson "A-Drive" is similar to the Licensing drive in that it also uses three rollers riding between two disks. However in the Acheson drive the rollers ride in the valleys formed by the two concave cone shaped disks rather than grooves cut into the disk faces. Also the drive differs by relying on direct mechanical force to tilt the rollers rather than gyroscopic action.

The Acheson drive was recently qualified by USAF at Wright Field for 1000 lbs use, according to Acheson's H. V. Jacobson. At Acheson's laboratory, a 500 lb endurance test was successfully passed and the drive's ability to perform satisfactorily in environmental conditions of 50,000 ft altitude and extreme temperatures despite 100% overloads was demonstrated.

Navy and USAF also are interested in new approaches to hydraulic control speed drives. A Raytheon spokesman explained this is partially due to government reluctance to be limited to a single source.

To date the system have been in use on Seastrand as a single source of alternative drives (There have been others but the largest drive of the house now has gone to Seastrand). As a result, the spokesman pointed out, there is constant pressure from growth and purchase sources to encourage competition in the field.

One new hydraulic approach, selected by Stokes Division, (Fairchild Engine and Airplane Corp. though it has not received any Seastrand support, is concentrated pointing for Navy purposes. It is based upon a German patent and is similar to that of the well known Seastrand drive in that the hydraulic system is engaged to activate, or deactivate a mechanical drive whenever the input speed falls below or above a certain action speed. While the Seastrand drive is said to use a gas gas arrangement to relieve the differential effect, the Stokes and Vallen drives use hydraulic damping.

The catch to purely mechanical drives, said a Stokes engineer, is that if they ever do slip, the subsequent jolting of the control surfaces would cause rapid progressive failure.

Presently alternative drives are not being overlooked either. Despite the

anxiety towards alternatives by the USAF using constant (AW June 24, p. 81) advance weapons planners are aware that nothing but precision may be feasible in future target and rocket attacks, since in those aircraft there may be no suitable powerplant elements from which to extract mechanical power directly. However, for the sake of efficiency, there seems to be a strong interest from "soft" computer based systems to "hot" conventional gas systems.

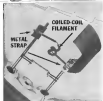
One engineer contacted by Aviation Week suggested up the industry side of this interest in constant speed drives by saying that it is possible that he

1960, if the wing to engine (or main part) doesn't completely upset assumed aircraft trends, the demand for constant speed drives will amount to \$100 million per year.

Solar Will Supply Turbine Generators

An Materiel Command has awarded Solar Aircraft Co., San Diego, a \$54,000 supplementary contract for gas turbine powered airborne generators. Sets will be powered by Solar's 50 hp Mac gas turbine engine and will be installed in the Boeing KC-97 tanker.

G-E
600-watt
Landing Lamp
has...



3 ADDED FEATURES AT NO ADDED COST!

LONGER SERVICE LIFE—G-E's new coiled-coil filament is rigid, needs no support wires to prevent sagging. This means there is no wiring action between support wires and the filament, eliminating that cause of premature lamp failure.

CONSTANT BEAM AIM—G-E's Landing Lamp No. 4539 uses a new method of "anchoring" each filament and to a lead-in wire. This calls for precision spot-welding of two metal strips, insuring rigid support between the filament and the lead-in wires.

IMPROVED BEAM PATTERN—The precision design and location of the filament guarantee a circular beam pattern of most even intensity. Earlier types had "egg-shaped" beam patterns that were less uniform.

For more information on General Electric Landing Lamps, or any of the other General Electric Aircraft Lamps, call your G-E Lamp Distributor, or write: General Electric Co., Minimum Lamp Dept. AWA8, Nela Park, Cleveland 12, Ohio.

Progress Is Our Most Important Product

GENERAL ELECTRIC

*From Whittaker's
Hydraulics Division:*

NEW TINY SHUT OFF VALVE WITH



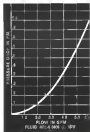
Extremely low pressure drop is the striking feature of this new Whittaker valve. This is made possible by mating a rotary plug to a sleeve thus providing straight-through flow.

Valve shown is equipped with thermal relief valve that is mated to the pressure port to relieve thermal pressure at the downstream port. This eliminates need of drain port or vent.

New Whittaker Rotary Shut Off Valve
is now in use as emergency
landing gear shut off unit
in Lockheed Electra.



EXTREMELY LOW PRESSURE DROP!



At 1000 PSI, leakage is only two drops per minute, because the pressure is used to seal the already close clearance of the mated plug and sleeve.

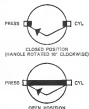


Here is a remarkable achievement in valve design—a design suitable for any type of shut off application!

No valve so small and light has ever incorporated all the features of low pressure drop, minimum leakage, plus straight-through flow—attained by incorporating a rotary plug that is mated to a sleeve. The valve is smaller than comparable units of this type.

Although the customer's specification called for a maximum torque of 45 in./lbs. Whittaker tests showed torque ranging down to about 20 in./lbs. Since the valve lends itself as well to motor actuation, this low torque permits the use of smaller motors and less power.

This valve is available with or without thermal relief. It is typical of the many contributions Whittaker has made in hydraulics—innovations available to you in quantity now!



PERFORMANCE

SERVICE FLUID: MIL-G-5606 (Similar units suitable for other fluids and pneumatic service.)

WEIGHT: 38 Ozs. (with thermal relief, 1.1 lbs.)

TEMPERATURE: Ambient, -62°F to +160°F.

Fluid, -60°F to +160°F. (with app. "O" rings to 275°F.)

PRESSURE: 3000 PSI (proof 4500 PSI—burst 7000 PSI)

RATED FLOW: 6 GPM

PORT SIZES: 1/8", 1/4" and 1/2".

Whittaker

CONTROL SYSTEMS
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Windsor • Baltimore • Seattle

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80 N. China Avenue • Los Angeles 24, Calif.

Gentlemen: Please send me further information on Whittaker Minutely Operated Shut Off Valve (E-78 148721)

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Company: _____

Address: _____

City: _____ Zone: _____ State: _____

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Service!



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atmospheric conditions and optimum working environment. These features
assure quality and timely delivery to the industry we proudly serve.

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Rotted Free Gyres, Vertical Gyres,
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Intervallometers, Accelerometers,
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Challenging assignments exist for highly qualified engineers.



SOUND LABORATORY which Douglas Aircraft will use to determine a measure of passenger
anxiety due to noise within airplane cabin, engine, fuselage and various other test
rooms. Cost of building was \$500,000.

Laboratory Seeks Sound Index

Santa Monica, Calif.—Standard
Comfort Index for transport vehicles will
be derived by Douglas Aircraft in a
statistic out of measure of passenger
anxiety due to noise. Project will
make use of company's new \$500,000
sound laboratory.

Douglas has used an ACI for
polymer design aircraft for about six
years but inclusion of statistic is
new. It is applied only to sounds of
comparable characteristics and com-
position.

Progress and accuracy of mea-
sure caused by a sound is the degree
to which it interferes with normal
speech. But a Douglas engineer points
out that an engineer can interfere with
speech without being annoying.

Jet noise spectrum can be re-
produced in Douglas facilities and means
of detecting and measuring it can be
employed for their effect on passenger
comfort. Human subjects will be used
to determine effect of different combina-
tions of pitch, intensity and frequency
distribution.

Laboratory consists of an isolation
room, machine chamber, reverberation
room, noise bridge test room and
acoustic room. Fatigue test room will
check the effect of the jet noise spec-
trum on structural. Facilities are also
available to study effects on various com-
ponents.



ENGINEER is showing terms test equipment
in the machine chamber of the new Douglas
Aircraft sound laboratory. Center also has
built such a chamber for determining pre-
cise effects in related to the comfort of
passenger.

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TRACE**
MACHINE
TOOL
CONTROLS

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catalogue

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and increased profits
from 1, 2 and 3 slide
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chines and numerical
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TEFLON covered air frame seals

CHB Teflon covered SILICONE
RUBBER seals are solving surface
and power package sealing problems
where low friction, sliding action,
cleanliness, fast or synthetic lubricant
assistance are required. Have a real
application? Call CHB. "It's done in."

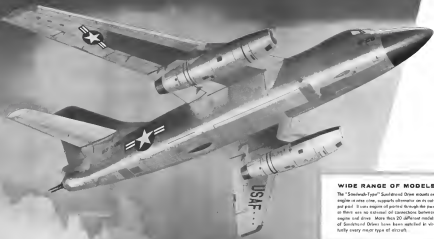
**CONNECTICUT
HARD RUBBER**

THE CONNECTICUT HARD RUBBER CO.
NEW HAVEN 2, CT. **CHB** CONNECTICUT





First in Constant Speed Drives



SUNDSTRAND DRIVES

**Provide Trouble-free
Constant Frequency
a-c System for RB-66**

More than 30,000 flight hours in Douglas B-66 and RB-66 Destroyers—that's the current service record for Sundstrand Constant Speed Drives. During this time the Destroyer's 400-cycle electrical system has proved itself to be virtually trouble-free—a necessary for all-weather, around-the-clock photographic, mapping, and bombing missions. Two Sundstrand Drives power the Destroyer's electrical system, each alternator supplying a split bus. Automatic paralleling is possible when desired with the equipment installed, but optimum performance is assured whether alternators operate singly or in parallel. The extremely compact and lightweight installation has its oil system integrated with the engine lubrication system.

Service experience with the Destroyer is another example of the record for reliability and performance that has made Sundstrand first in constant speed drives.

WIDE RANGE OF MODELS

The "Steelweb-Type" Sundstrand Drive mounts on engine or motor shaft, supports alternator on its output shaft. It was engine oil ported through the gear as there was no external oil connection between engine and drive. More than 20 different models of Sundstrand Drives have been applied in virtually every major type of aircraft.



SUNDSTRAND AVIATION

DIVISION OF SUNDSTRAND MACHINE TOOL COMPANY • ROCKFORD, ILLINOIS
Sundstrand Drives: Denver, Colorado • Western District Office:buquerque, New Mexico

CONSTANT SPEED DRIVES • AIRCRAFT ACCESSORIES



TA-20 TRANSMITTER, RA-16 RECEIVER

Each provides 260 crystal-controlled channels from 118.0 to 122.95 megacycles with 50 kilocycle channel spacing. Receiver 3-megawatt assembly with carrier-operated speech control. Transmitter, 22 watts minimum of ± 1 output power.

*Nearest
thing to
Personal
Contact!*

RG-9 RECEIVER,
TG-16 TRANSMITTER

Receiver: 118.0 to 122.9 megacycles. Single channel operation with 50 kc channel spacing. Transmitter: 108.0 to 125.9 megacycles. 50 watts ± 1 output power. Single channel with facilities for dual channel operation on output frequencies within 900 kc.



Bendix VHF Airborne-Ground Communications

The last way to talk to somebody is "in person." No question, then, about getting things straight. But, of course, it's not of the question in this age of travel.

The next best thing to do is to match this way of communicating as closely as you can. That's Bendix' VHF Airborne-Ground Communications.

The complete system consists of the RA-16 and TA-20 Airborne Receiver and Transmitter, and the RG-9 and TG-16 Ground Station Receiver and Transmitter. Combined weight of the airborne units including power supplies is 45 lb.

TO DATE, 90% OF THE AIRLINES THAT HAVE CHANGED TO 360-CHANNEL OPERATION HAVE SPECIFIED BENDIX RA-16 RECEIVERS.

If you have a communications problem or see opportunities reflecting your present equipment, we would like to present our story. Write us direct, Bendix Radio Division, Aviatron Electronic Products, Baltimore 4, Maryland. Or West Coast—10590 Magnolia Blvd., North Hollywood, Calif., Export—Bendix International Division, 590 East 42nd Street, New York 17, N. Y.

Circle 14 on Reader Service

**Bendix Radio
Division**



BUSINESS FLYING



ORIGINAL YL-23 prior to geometric boundary layer control modifications is fully suited to handle low banking turns.

Performance Jumps in Cleaned-Up YL-23

Major performance gains are possible on conventional business aircraft configurations by applying classic rules of geometric boundary layer control, a detailed study of a typical light twin has completed recently in the Aerobics Department of Mississippi State College, Ames.

Under direction of Dr. August Reppert, well-known low drag proponent, the department modified a Beech YL-21 Twin-Bonanza loaned by the U.S. Army, cleaning up the airplane's exterior to evaluate application of positive boundary layer control on a modern light twin. Extensive flight

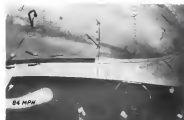
tests of the modified configuration showed:

- Approximately 16% reduction in power required at nearly all airspeeds.
- Reduction of 14% in effective parasite drag coefficient.
- Increase of 45% in gas efficiency.

There was also a slight increase in



MODIFIED YL-23 has dorsal fin removed, external antennas, wing root fairing and smoothed tail surfaces to reduce drag.



ORIGINAL FACILE (top) experienced five several with thrust separation at 90 mph, and continued to grow until it was complete at 64 mph. Propeller is finished, but below is modified model before at 75 mph, aircraft, separation was avoided in 72 mph. Fuel nozzle and wing root is detailed in bottom photo of modified EL-23.



propulsive efficiency. These factors together provide three marked engine improvements in performance.

- 25% increase in range;
- 10% increase in maximum speed;
- 10% gain in endurance.

Shortfield characteristics were also apparent, the test pilot reported.

YL-23 and its EL-Rapet was a good vehicle for its observation and modification having been delivered to the Army in one of several hand-built prototypes for service test and having accumulated considerable flight time before it arrived at Mississippi State College. Frank represented the period prior to production experience wherein the learning curve runs to make for more efficient finished product with optimum "point"-rough service life provided an accumulation of details and fat spots, detailed across panels and other components all tending to run the original aerodynamic configuration faithfully to provide obvious order from fat spots.

These factors, in addition to characteristics of the general design configuration evaluated by Dr. Rapet prior to his modification program embracing pressure boundary layer control plus supplies, provided a study which offering many broad across-the-board pointers to light search designs.

YL-23 Critique

External visual inspection of the YL-23's general aerodynamic configuration by Dr. Rapet's group prior to modification showed these characteristics:

• Wings

These were comparatively good for production components in that flat bottom wing was noticeably used and number of leading edges were kept to reasonable tolerances.

Inspection across panels fitted poorly, the report notes, and in service they had become distorted so that they were series of aerodynamic locks at high drag. Auxiliary fuel tank cap cover and scupper access door were located in a high velocity region and were consist of aerodynamic loss. In flight the cap cover lifted sufficiently to become a very effective spoiler. Scupper door was located in a comparatively higher pressure region and, according to the report, may contribute the reverse internal pressure initially to lift the cap covers into the flow.

Although the wing leading edge is well rounded, many of the construction joints were either protruding into the surface or so great of being corners turned had their holes elongated, resulting in skin roughness. Where damaged rivets were used, several fat spots or depressions were noted.

At the wing contour approached the spot, a noticeable fat spot was no-



FLY WEATHER-WISE



These weather items prepared in consultation with the United States Weather Bureau

TEMPERATURE VARIATIONS IN RELATION TO ALTITUDE...

TEMPERATURE decreased in a single flight may vary as much as 100°F. or more. These variations are associated with altitude and weather patterns and can affect flight performance.

Temperature and altitude—Heat from the earth warms the atmosphere with usually decreasing effect as altitude increases. Temperature normally decreases with altitude at the rate of 31°F. per 1,000 ft. At the tropopause (top of troposphere) temperature remains almost constant up to 80,000 ft. Therefore, modern aircraft encounter colder air in the tropopause layer which varies from about 20,000 ft. on the polar air masses to 50,000 ft. in the tropical.

As altitude increases from approximately 80,000 ft. to 120,000 ft., the temperature becomes almost an actual condition. This is the result of strong absorption of the sun's ultra violet rays in the layer of ozone gas at very high altitudes.

At still higher altitudes, the temperature varies to extreme cold.



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Instant control response can be yours despite extreme temperature variations, thanks to the wide range of temperature characteristics of these top quality Mobil products.

Mobil Aero Hydraulic Oil HP and HFA—These low pour point and high VI oils help insure trouble free operation of hydraulic control systems, brakes and servos through all temperature ranges.

Mobilgrease Aero Lo-Temp and General Purpose—These Aero greases help insure smooth operation of all sliding and rolling surfaces of aircraft parts... control systems, bearings, and gears.



THE LIFE OF A FIELD ENGINEER

George Tully is one of the Hughes Field Engineers assigned to an Air Force base in California. He is highly respected, too, by the personnel of the base, for reasons of the technical knowledge of the Hughes Aircraft Company.

Hughes Field Engineers are responsible for all phases of support for the maximum field performance of Hughes electronic systems controls systems and ground stations.

The background and experience they gain by such training provide an overall systems knowledge which is unsurpassed. Their training ensures them an unbiased focus in the field of electronics.

IF YOU ARE AN ENGINEER OR TECHNICIAN interested in the mounting and recording type of work, and a head-and-neck of your experience in the system below:

The World's leader in advanced electronics

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RESEARCH & DEVELOPMENT LABORATORIES Hughes Staff Relations, Hughes Aircraft Co., Culver City, California

continued and immediately after the spot there was a curious inverted helix. This geometry was sharply reversed at the spot.

Under the wing there was a series of straight strokes that made abrupt turns at each stroke to form the lower surface.

Underneath the ribbed section, there were numerous perturbations such as lower rivets, three vents and both fixed access doors.

Leading Edge

Leading edge installation was rough. The upper rivets, and was located in a critical high velocity region. Wing leading edge panels extended into the flow.

Leading edge skin on the left wing did not fit the spot and resulted in a leak in a critical position, the outboard section of the upper surface.

The wings did not have any root fairings.

Gaps between tabs on the riblets, between outboard and inboard flaps and between flaps and leading edge were noted. Folded flaps and airfoils are possible. A high drag source, particularly in case of gusty flow, even noted ahead of the flow where some drag penalty, the report concludes.

Engine nacelles

Nacelles not well and are complex. Many areas for improving airflow in the leading edge with the same restricted gap was located in a high velocity region and where and doors were not sealed. Vacuum pump vent and oil vent were located in a high velocity region atop the nacelle.

Oil filler cap access door is obstructed and lifts in flight.

Geometry of the engine nacelle above the wings is not completely satisfactory, the report states. Oil leaks are located that this contributed to spin was flow over the ribbed area of the wings.

Rapier's upper engine nacelle was too far of vents for engine and accessories. There are 15 critical vents shown and the like on each wing and nacelle to take care of the two fuel cells and single engine in this area.

Pinpoints

This showed the most promising area for possible breakdown. Low cost application, according to the report.

Pinpoints were given and features were analyzed, rough to some extent but done almost immediately.

Barbed wire and down, was noted. Underneath of the leading edge, the report found, including lip, joint, vent, door, access door and leading edge element.

Rapier's door and cabin door fit approximately, presented a large volume of

airflow into the boundary layer on the right side of the leading edge.

Requirement for a door fit and an observation needed to be made. The Rapier group felt that its cost could be eliminated.

Added Noise

In addition, to smooth points around the cabin windshield contributed to drag, this also provided a source of high-frequency noise, the report added.

Ones and globe path antennas are located in a high-velocity region well forward on the leading edge.

High drag external vibration could also be a source of noise, the report said.

Propaganda

There was found several drag sources including nacelles at the dorsal fin, the report stated. Underneath all of the leading edge there was a significant source of drag, speed however much. A lot of the leading edge is fixed by two massive sections ahead of the



Airplane Speeds Fencing Job

Homebush "bunker" fitted underneath Piper Super Cub was possible width of 600 foot points and would be used in 10 ft. flight base in area of New Mexico. U.S. Forest Service responsible for erecting the fencing, estimates that the most important job is to erect a fence by a man with three horses would have taken 60 days. Piper dealer Ralph Brown, Redondo N.M., received the letter and in which steel points in bundles of 10 weighing about 110 lb., were dropped with precision attached from 11 000 12-000 ft. altitude. There was a 20-ft. square of lead.

MORE ABOUT BRISTOL'S "WHISPERING GIANT":

A new Britannia mark: non-stop . . . London-Vancouver, 14 hrs. 40 mins.



In a dramatic demonstration of range and speed, the jet-prop Bristol Britannia recently set a new mark for a liner operation.

The "Whispering Giant" flew 5,100 air miles non-stop London to the Pacific Coast in 14 hrs. 40 mins. at an average speed of 350 m.p.h. with 6½ tons payload.

Living up to her worldwide reputation for great range and high speed, the Britannia flew this record-breaking flight with casual ease.

Passengers left London after breakfast and arrived

in Vancouver for lunch . . . relaxed and refreshed after a completely restful and enjoyable ride.

For operators, this was a most, practical example of turbine travel capabilities. In particular it emphasizes again the profitability of Britannia operations. The flight was made with a payload equivalent to 38 first-class passengers and baggage. The Britannia loaded with sufficient fuel for another 400 miles of flying.

World's largest, fastest, quietest jet-prop transport, the Britannia is the most versatile airliner flying today. Powered by four 4,130 h.p. Proteus engines, the

"Whispering Giant" uses standard runways and fits into existing air traffic patterns. She has been chosen by world operators for a wide variety of routes—from the longest trans-polar flights to short inter-city runs.

In a matter of months, Britannias will be flown between New York-Washington and New York-Miami by Northeast Airlines and between Mexico City-New York by Aeromexico de Mexico.

The same type of aircraft will also fly non-stop Atlantic routes for BOAC and EI Al from Atlantic, and trans-polar and cross-Pacific routes for Canadian Pacific.

World-wide recognition and demand:

Britannias are in service on BOAC routes spanning four continents and have been ordered by Aeromexico de Mexico, Canadian Pacific, Coteau de Airborne, EI Al Belfast Airlines, Flying Colours Air Transport, Northeast Airlines, the Royal Air Force and the British Ministry of Supply.

BRISTOL
→
Britannia
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Bottom photograph of supersonic flight picture in vital center.

There is a formula behind America's supersonic might

The fate of freedom cannot hinge on trial and error. Our future security depends on making major supersonic advances at a staggering tempo...on developing aircraft, manned and unmanned, to fly at the beyond today's speeds and altitudes.

North American Aviation's experience in the design and production of supersonic aircraft—by far the greatest in the Free World—is focused right upon this vital problem. The new aircraft and weapons systems now in progress will be as remarkable tomorrow as these achievements of today.

Supersonic capability of North America's brilliant F-100 fighter brings man his given the Air Force, its most dependable supersonic fighter. In 1953, the first production line F-100 flew faster than the speed of sound on its first flight. In 1954—two years before any other supersonic airplane became operational—the Air Force had F-100s in wing strength. There's

still no Air Force operational airplane that can match its track and cockpit versatility. Supersonic history will be made by North America's X-15 experimental rocket-powered airplane. It will carry man faster and higher than he has ever flown before. It is setting the pace for the Air Force of tomorrow.

Other major supersonic projects at North American include designs for the Air Force at the Los Angeles Division, and the A32, a carrier-based attack weapon system for the Navy, at the Columbus Division.

From the P-51 through the F-86 and the F-100, North America has designed planes with growth potential to use more power as it becomes available. It has translated this ideal performance into wing strength, stability—accuracy, speed, and at least possible cost.

The formula for supersonic strength in the future is supersonic experience today. North America has it.

NORTH AMERICAN AVIATION, INC.

(Los Angeles, Fort Worth, Dallas, Kansas City, St. Louis, Miami)

NORTH AMERICAN HAS BUILT MORE SUPERSONIC AIRCRAFT THAN ALL OTHER COMPANIES COMBINED

disaster huge. Heavy large aircraft was large and became serious of emergency. The and under area of similar construction except that a rubber sealing strip extended into the net line at the top and dorsal edge. Ribbed structure of these sections also contributed to drag the repeat kind.

Modification Program

Many part of the B-57 modification program was aimed at reducing the number of parts, increasing the weight and reducing controlling weight. The new and F-100s bonded to the surfaces with epoxy resin were used. This added 260 lb to the airplane's normal weight.

- Landing lights were removed from the wing. One was installed on the nose and the other was submerged in the fuselage rate case. Total head tube was also removed to the nose.
- Dorsal antenna was buried in fiberglass housing at the wingtip.
- Ribbed lips, antenna elevators and radars were covered with fabric and doped, ribbed surfaces of the stabilizers were smoothed with balsa wood and fiberglass. They and antenna gips were sealed with a brush material.
- Fairings were installed at the wing roots and on the engine nacelles.
- Inspection doors and access panels were refitted or replaced. Wings were caulked.
- Dorsal fin was removed and fuselage from the nose to put off of the baggage door was caulked.
- VHF antenna was relocated and made to serve as the altimeter for the ADF wing antenna. Front mount for the ADF is an extension of the heater exhaust.
- A more compact unit replaced the previous unit because antenna.
- Various vents and drains on the fuselage were caulked to produce zero wind drag.
- Engine oil and vacuum pump vents that had been at high pressure again of the engine were also relocated and caulked into the supersonic exhaust tubes.

Emergency Use

Landing gear was not modified on world B-57s feel that considerable power might could be had with it work of this area if further research could be done to enhance the effect of such characteristics. Such characteristics and crew efforts. Both America's power intention in leaving portions of the wheel exposed now to provide effective shock absorbing points should be considered, allowing landing to be made. Actual case history of such landings have shown that this latest construction greatly to minimizing under-vehicle damage.

Elimination of the dorsal fin did

not affect angle of attack speed, extra payload data, indicating that in this configuration, speed with left engine out remains at about 87 mph. There was no evidence of roller lock, according to B-57's report, the aircraft operations on vertical lift and roller having characterized their penalty.

Improved flow characteristics of the modified airplane resulted in better than fielded characteristics, the report notes. These being reflected in the power at low speeds to provide positive control. Cruise in level flight was increased 20%, providing more air for lift and landing.

These advantages were gained at the

expense of lift warning, the report notes. There's Mississippi State College developed a Life Science Indicator that basically measures the thickness of the turbulent boundary layer and provides a signal proportional to the lift coefficient. Signal is generated by radio and visual means to the pilot.

Detailed before and after photographic studies of the well tested span area X-15 made by Mississippi State College's Aerodynamics Department show the flow improvement's achieved.

While the performance gains on ground in this modification would appear to be attractive to the civil owner, a major drawback exists from



The Impatient Pilot With The Missing Part or So Long On The Runway

Once upon a time there was a flyer in a hurry to get flying. But he couldn't. His aircraft lacked a part (they often do).

So he called Air Parts Supplier, a man without a day.

"I need a Subab pin," he said plainly, and hung up firmly.

The Subab pin arrived the next day. But it wouldn't fit. He sent a back, in a half and called another Parts Supplier.

"I need a Subab pin," he said plainly, accounting every syllable and leaving his comments. He hung up firmly.

Some weeks. No fit (unless you count the flyer's).

Then he called Airwork. But—before he could hang up, somebody started making suggestions.

So—the next day he received the right Subab pin.

MORAL: When you need spare parts, call Airwork. They have industrial know-how to get the right part (and the right information)—the first time! These 2 million dollar inventory helps, too.



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P.O. Box 37111

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WASHINGTON • CLEVELAND



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cent would be Civil Aeronautics Administration approval. On a major change, such as removal of the dorsal fin on the Twin Otter, CAA would probably require the owner to submit the airplane to extensive engineering and flight tests, both time-consuming and expensive.

The U.S. Army study contract with Messerschmitt was not intended to produce immediate results, but rather to develop broad criteria as the benefits of geometric boundary layer control which light aircraft designers could apply to future projects.

An AREA Transportation Corps official told AVIATION WEEK that the Corps was not inclined to bid on proposals to modify its current fleet of airplanes to incorporate the modifications developed by Dr. Ruppert. Fuel savings alone would pay for this cost in about 10 years operation of the planes.

Business Flying Booms Philadelphia Airports

Activity at both city airports near Philadelphia is booming as a result of steady increases in business plane traffic. Traffic of "small business aircraft"—mostly business planes—went up 18% at Midt 31 at International Airport compared with the same period last year. The increase of North Philadelphia Airport was 22%. Private planes made 12,813 landings and takeoffs at the former field during the Jan. 1-Midt 31 period, slightly under 14,000 same months of the latter field.

Philadelphia's Commerce Department is encouraging location of new industries to city-owned land near North Philadelphia, pointing out its convenience in relation to use of both airports. There are 71 business and pleasure planes permanently based at the field; some 65 planes month used by companies are kept at International.

Airwork to Expand Business Flier Forum

Milwaukee, Wis.—There is enough growth the scope of its annual Pratt & Whitney engine forum to cover broader fields of interests for business pilots are being developed by Airwork Corp. The engine overhaul and equipment supply firm will expand its previous seminar course to two days, introduce seminars on light fuel systems, accessories and navigation equipment. Meeting will be held at Milwaukee Sept. 19-20.

Also planned are static and flying displays of equipment for the commercial aircraft market, and a show of new business aircraft.

Part two will have morning sessions on fuel systems, and afternoon will be



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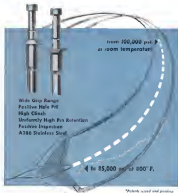
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To meet the design requirements imposed by extremely high-speed aircraft and missiles, the Cherry Rivet research and development department has introduced the "600" A386

stainless steel blind rivet. Due to the strength capabilities of the "600" rivet is available from Townsend Company, Cherry Rivet Division, P.O. Box 2107-N, Santa Ana, California.

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devoted to aerocraft. Letter will be organized so that each aerocraft manufacturer will hold individual "round table" discussions with interested users—"circle of information," as Newark calls them. Morning sessions of second day will cover communications and navigation, afternoon will be devoted to P/W engines.

PRIVATE LINES

Coma do Brasil, petro affiliate of Coma Alcantara Co., Woburn, Mass., obtained permission from the South American government to import equipment at a special exchange rate for a new plant in Sao Paulo which will produce 170 and 180 business planes.

Piper Aircraft sales for first nine months of fiscal year ending Sept. 30 were \$11,513,198, with net income after taxes being \$2,438,026. Sales were up 13% and net income 35% compared to same period last year. In the same monthly period Piper built 1,900 aircraft, principally business and utility aircraft.

Formation of a Venezuelan common oil retail sales firm has been completed by Photographic Service Corp., Ltd., Toronto, which merged its former Caracas operation, Avianova Nacionales with Servicos, an established air photo laboratory and photographic service organization.

Business deals were doubled by a salesman in the Los Angeles area using a Beech Bonanza and selling motor scooter to some spending men. Ben Corder, owner of Advance Carpet Sales, which has competing for 50 retail stores in the area, seldom flies the Bonanza beyond metropolitan Los Angeles. He beats traffic competition by landing at the airport field using the scooter to visit clients.

Third consecutive annual contract for overhauling F4U's & Army's Bell and Sikorsky helicopters was awarded Howard Air Service, San Antonio Tex. New contract covers period Feb. 1, 1957-June 30, 1958.

Prized at under \$100, radio from motor car use aircraft's rigidity lighter in power output. Volunteer will operate via a hand frequency, program retraining, operator pushes a button to talk. Unit is being distributed by Air Associates Division, Electronics Communications, Inc., Yonkers, N. Y.

Five Beech B50 Twin-Bonanzas, valued at more than \$187,000, have been ordered by Swiss and Moroccan Air Forces for liaison work.

MISSILE SYSTEMS FLIGHT DYNAMICS

Weapon systems management activities in Lockheed's Palo Alto, Sunnyvale and Van Nuys organizations demand accomplishment of a high order of flight dynamics areas such as: Analysis of exotic dynamic systems and evaluation of stability and control system criteria for requirements with 3 or more degrees of freedom; development of techniques for the analysis and interpretation of flight dynamics test data at hypersonic speeds; study of special dynamics problems arising during preliminary design and development of missile systems; techniques are applied. Please address the Research and Development Staff, Sunnyvale 31, or Van Nuys 19, California.

Left to right: S. J. Edwards, flight dynamics; B. W. Marsh, aerodynamics; M. Tucker, Aerodynamics Department manager; and R. L. Nelson, project aerodynamics, discuss energy dynamics.

Lockheed

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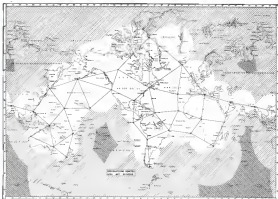
Clifton Precision began delivering 5 to 6 synchros from the product line more than a year and a half ago. Since then, production has mounted steadily, and we are now in a position to serve more and more customers with these 7 models, very easily.

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AVIONICS



COVERAGE of a possible distribution of 31 Navaho stations. Shaded area of shaded Navaho is defined by heavy connecting and that of Navaho II and Navaho rho by light connecting.

3-Mile Accuracy Claimed for Navarho-rho

By James A. Fieser

Rome, N. Y.—Wide-area navigation systems to replace those used in the days of ancient sailors are now being developed by the Navy. A modified version of Navarho long range navigation system, according to a Rome Air Development Center spokesman.

Development was made here at a symposium for presentation of results of a joint Rome and Wright Air Development Center evaluation of the Navarho system. Representatives of the military services and civil aviation agencies.

Navarho is the long range navigation system officially selected by the Air Commanding General as U. S. candidate for adoption by the International Civil Aviation Organization, which places it in competition with such systems as Decca and Decca and other classical military systems.

The new version of Navarho, called Navarho-rho, is one of three modified Navarho systems discussed. Two others, called Navarho II and Navarho-III, were suggested strongly by Federal Telecommunications Laboratories which developed Navarho under a Rome Air Development Center contract.

Three New Versions

All three modified versions of Navarho operate from the same ground station transmission in the base Navarho system (AW April 26, 1964, p. 12) so that the mode of operation used by no more than one receiver will be determined by the receiver installation. Differences in system characteristics are as follows:

•Navarho. The standard rho-theta range and bearing Navarho system derives range by phase comparison of the received ground station signal with an internal precision frequency standard or clock. Bearing is measured by

amplitude comparison of pulse signals received from the ground station in the transmitted signal is switched in sequence among three directional antenna configurations.

•Navarho-II. Also a rho-theta system, bearing is obtained in the same manner as with Navarho but range is measured through derivation from two ground station signals of a hyperbolic line of position (LOP) which intersects the bearing line.

•Navarho-III. A fully hyperbolic system, Navarho-III requires the reception of three ground station signals to generate two intersecting hyperbolic lines of position.

•Navarho-delta. A circular position fixing system, Navarho-delta measures distance in the same manner as Navarho but from two ground stations to determine position by the intersection of the two range circles. A third ground station may be used to resolve the ambiguity of the range circles intersecting

eppe



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The free world's most powerful production turbojet—Pratt & Whitney Aircraft's J-75—is a major advance in the science of aircraft propulsion.

Producing about 50 per cent more thrust than the famed J-57, its forerunner, the J-75 is in the 15,000-pound thrust class. Its power can be greatly augmented by use of an afterburner.

The J-75's basic configuration stems from the J-57's axial-flow design, which features simple, permanently fixed stator vanes constructed. Despite its 50 per cent increase in thrust, the J-75 is only slightly larger than the J-57, with a lower specific weight and outstandingly low specific fuel consumption.

Already announced as the power plant for the Republic F-105 fighter for the Air Force and for production models of the Navy's Martin P6M seaplane, the J-75 will also power other Air Force and Navy high performance aircraft still on the classified list. Its commercial version, the JT4, will power a majority of the Boeing 707 and Douglas DC-8 jet airplanes ordered by the world's leading airlines, while others will be powered by the JT3, commercial version of the J-57.

Quantity production of the J-75 again demonstrates that—whatever form the future takes—Pratt & Whitney Aircraft is prepared to offer continued advancement in power plant design and production.



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How Holley's Compressor Governors Help New Jets to Supersonic Speeds

"City-saver" Air Force men call them the J-57-powered F-100, F-101, F-102 and Navy F9U, with level flight speeds faster than sound. And city-savers they could well be. Certainly their rapid approach to the fringe of Mach 2 terrifies a new era in the progress of jet flight.

Shoring up the development of this new breed of supersonic fighters, Holley engineers, working closely with Pratt & Whitney Aircraft on the J-57 engine, designed the compressor bleed governor.

This new Holley compressor bleed governor is one more example of Holley's continuing leadership in the design, development and manufacture of superior engine control systems for both military and civilian use.

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design, development
and manufacture
of engine bleed
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charts ground with logarithmic scale rates and time under conditions for differential propagation delays. Such a system would be of use in air and space navigation where the time is known to plot position accurately on a chart is acceptable.

Norad's Sites

The future of Norad is set as all of its four systems will be determined during preparation of the U. S. position to be presented at the International Civil Aviation Organization meeting at Montreal on September 19-24. USAF's Air Staff presents a study of the results of the collision and the proposed future program for the purpose of establishing the Air Force position.

The Air Force position will be coordinated with the other military services by the Joint Chiefs of Staff as to increase the Armed Forces position for submission to the Air Coordinating Committee which has responsibility of establishing the U. S. position for international presentation.

According to Norad's development 10 ground stations are capable of providing world-wide coverage. A possible distribution of stations is shown in the map. Spacing between the stations is about 1,000 mi. the approximate maximum service range. On the map, heavy connecting outlines the service area for standard Norad and light connecting the service area for Norad-III and Norad-IIIc.

Stations must be used within service range of one another to maintain the synchronization required for distance measurement. This is because the frequency standards of the Norad-III and Norad-IIIc cannot be set to place with even ground station carrier which they are expected to track. Additionally, Norad-III, which does distance from phase comparison of two ground station transmissions, requires synchronization of all ground station events.

Norad's Fundamentals

Standard Norad is a low frequency navigation system that provides position information in the form of bearing and radial distance from one ground station. With the required circular spacing of 1 i.e., 70 circuits are available worldwide in the world in the 10,000,000 allocated frequency band of 90-110 Mc.

Bearing from a ground station is derived from the transmitted pulsed carrier. At the ground station three antennas towers are located at the corners of an equilateral triangle, approximately one third of a wavelength (about 1,690 yd) in a side.

The bearing comes is phased in for one sixth of a second but must correct normal and applied respectively to permit

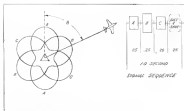


FIGURE 1807—transmission system of Norad's ground station transmission and sequence of the transmitted pulse signals.

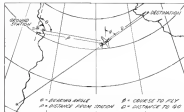
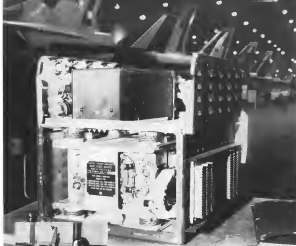


DIAGRAM of the coordinate system for bearing and distance measurement used with the standard Norad-III system.



COARSE and fine distance measurement in the standard Norad-III system is made by phase comparison of two wavelengths and carrier frequency.



Why do Vought electronic projects bring out the best in an engineer?

... Because they stand for the things an engineer values most.

There's theory and research adventure to begin with. There's the opportunity to systematize and package the most advanced components. And there's the good feel of production-line hardware at the end of a successful project.

Right now, the Vought engineer is experiencing these attractions in a number of different electronic efforts. And whether it's fire control systems, engine design, or power control development, it's a project that has his respect. For he knows — probably from experience — that he's been given an isolated challenge . . . that he is doing things that haven't been done before.

You understand the Vought engineer's enthusiasm when you examine his projects. Take the stabilization system for Vought's Crusader fighter:

Here, to begin with, was an epic problem:

The aircraft was designed to travel in the transonic regime where control stability is marginal or negative.

The engineer's job, to keep Crusader control in the cockpit by means of an electro-mechanical system the pilot can command with his fingertips.

Believing this problem, Vought engineers explored the dynamics of servomechanisms. They called on the latest in circuit designs, and they brought together revolutionary new components. Finally, they came up with a package — tailored for a small space in the aircraft, and for low-cost, trouble-free production, too.

... A man-sized program, in an area few engineers have the opportunity to explore. Typical of the electronic projects engineers can count on at Vought.

4 IMMEDIATE OPENINGS FOR ENGINEERS

Designer. Special support equipment designer for check-out of stabilization and other electronic systems. E E degree, or equivalent required, plus 3 to 5 years electrical or electronic design experience.

Reliability Engineer. To review and evaluate aircraft and missile components and to perform environmental tests. Requires E E degree, or equivalent, and knowledge of statistical quality control.

Systems Engineer for Design and Test of Communications, Radar, Fire Control, Infrared, and Navigation Systems. Requires engineering degree or equivalent, plus 2 to 4 years related experience.

Systems Engineer. To design and test electro-mechanical and electro-hydraulic servo control systems. Requires engineering degree, or equivalent, plus 2 to 4 years related experience.

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If R & D in electronics is conducted at Vought in modern facilities like this antenna range, one of many Vought labs where engineers are improving electronic weight, cost and performance factors.

On production lines like this stabilization system assembly setup (at right), Chance Vought produces the electronic control equipment its engineers have developed.





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of waves during each pulse, producing three light spot patterns for three stations plus.

A fourth pulse is applied to a single tower to induce an omnidirectional signal. An ultra-low-amplitude carrier pulse is also induced from this tower in time coincidence with the fourth bearing carrier pulse. As shown in the sketch, the first three sequential carrier pulses form a bearing grid referred to as A, B, and C. The fourth pulse provides a synchronous signal and is used to distance measurement.

The magnitude of the induced signal varies inversely of constant radius about the light spot patterns for each antenna plus. Since each antenna plus area is 120 deg. wide from the bearing ring, three omnidirectional 120 deg. separations are observed at constant radius from the antenna plus. These pattern characteristics determine the amplitudes of the received bearing pulses.

The receiver compares the relative amplitudes of the pulses to derive bearing to the station. An ambiguity of 800 deg exists in the bearing measurement but is not considered to offer a operational problem.

Distance Measurement

Distance is measured at the receiver by two different methods, both based on the principle of phase comparison. The first method compares the phase of an echo signal reflected on the fourth or omnidirectional pulse with a reference signal derived within the receiver by the dividing down of the primary frequency reference signal. The second method is based upon phase comparison of the received carrier with the receiver's reference signal.

The first method provides distance measurement over an interval determined by the modulation frequency. If the frequency is 179 cps, distance readings will be repeated every 0.47 meter miles. In the second method of distance measurement, the phase of the receiver echo signal is aligned at



FAMILY of hyperbolic lines of position are used for distance measurement by Navaho-H system.



NAVAGO-H electronic receiver installation.

the start of each trip with that of the echo signal at the ground station. Therefore, the amount of phase shift accumulating is displayed by the receiver as a coarse measure of distance in miles.

Distance measurements based on carrier frequencies are repeated every 1.5 meter miles and are, therefore, highly ambiguous unless set and oriented from the start of each trip or unless the two methods of measurement are used together to provide both coarse and fine distance measurement.

An accurate Navaho installation for the measurement of bearing only weighs 25 lb and occupies 0.5 cu ft. With the addition of a distance measurement unit and a crystal frequency standard, the weight of the installation is increased to 90 lb and the size to 2.0 cu ft.

Navaho-H System

If the fourth pulse (distance and omnidirectional pulse) of the transmitted signal from one ground station is used as the frequency and phase reference for the signal received from a second ground station, there is no need for a stable frequency reference at the receiver. This method, called Navaho-H, cancels the differential distance from the two stations and thereby locates the aircraft on a hyperbolic line of position between the two stations.

As with distance measuring in stand and Navaho, measurements can be made on the constant modulation line from the two ground stations or by differential phase measurement between the two stations. These two accuracy methods together result in a coarse and fine hyperbolic network. Based on a modulation frequency of 230 cps, the hyperbolic lines of position will intersect every 1/4 mi along the trackline. Thus, the point must know his position within

1/4 mi in the system must include provision for counting cycles of phase to resolve the system ambiguity. Precise distance lines of position are then established by constant phase sensitive means.

The receiving equipment to accomplish bearing and differential distance measurement consists of the standard Navaho bearing unit and, as a replacement for the stable frequency reference, a carrier ATR circuit which contains additional receiving equipment, a stored oscillator and a synchronous converter. Total installation weight will be approximately 40 lb and it will occupy 1.0 cu ft.

Navaho-HH System

In an area where more than two ground stations can be received, integrating hyperbolic lattices will create position fixes without the use of bearing measurement equipment. When the Navaho ground station transmission is not used in the manner it may be possible to obtain three to five mile accuracy throughout the service area. With first order corrections for differential propagation delays, even higher accuracy can be obtained.

The electronic installation required for Navaho-HH system consists of two one-half ATR boxes weighing approximately 30 lb and occupying approximately 1.0 cu ft.

The data display will be in the form of measurement delay readings.

This installation will include a computer to convert the hyperbolic fix coordinates to latitude and longitude. Such computers are, however, in development.

In stand and air service where a computer has sufficient time to plot a chart position manually, a computer may not be necessary.

Engineers of Rome Air Development



Missile Radome

Current radome for missile, capable of operating at extremely high temperatures, has been developed by Gladding, McBean & Co., Los Angeles, under Air Force sponsorship. Current radomes reportedly have a leadtime approaching that of aluminum.



ED MARQUARDT, 40, is the young, yet chief executive officer in the aircraft engine business. A graduate of the California Institute of Technology, he was director of Aeronautical Research at the University of Southern California prior to joining Marquardt Aircraft Co. in November, 1964.

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Engineers looking for a company to grow with, should look to Marquardt Aircraft Co. Here is why:

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In just twelve short years, the company has grown from one man's idea to an engineering and production facility employing more than 2,500 people.

But most important, Marquardt engineers have grown in skill, scope and professional ability along with the company's many exciting and rewarding projects.

Within the next few years, Marquardt will more than double its manpower. Even with this new increase in personnel, employees joining Marquardt now will have this same opportunity to grow with the company.

For engineers in almost every specialty—from production engineering and qualification testing to advanced research in hypersonic propulsion—Marquardt means opportunity.

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REPORT FROM RYAN

(Continued)

New Engineering Opportunities Created as Ryan Projects Mushroom



NAME IS RYAN RYAN VICE-PRESIDENT AND CHIEF ENGINEER steps out before a drawing of new Engineering and Research Center.

New Engineering and Research Center To Meet Ryan's Expansion

Construction of a modern two-story, engineering and laboratory building has begun at Ryan, so soon the company's expanding work in Jet VTOL—Automatic Navigator—Jet Drives—Mach Gun—Jet Motor—Rocket.

The new facility will provide additional quarters for many of the 1000 employees in Ryan's fast-growing engi-

neering division. It will also house complex, new chemical, metallurgical, instrumentation, environmental and sample equipment.

With new in six Ryan employees in engineering, this division has tripled in three years. Its mushrooming growth reflects Ryan's increased importance as a research facility in modernization, propulsion and electronics.



RYAN ENGINEER "probes" VTOL up-to-date possible cockpit.

Vertical Flight Probed with New VTOL Cockpit

Research was done the day is brought up—in the Ryan Vertical. To probe this new realm of flight without burning arbor in a risk pediment daily by Ryan engineers. Their secret? A variable cockpit connected with electronic equipment.

Ryan's flight simulation laboratory is a prime tool in the use of new aircraft designs. Both the Vertical and the subsonic, supersonic drives. Verticals are just through their years via established flight test. Ryan leadership in this revolutionary new concept of flight is based upon 200 million man-hours of VTOL research and development. It is another example of how Ryan builds better.

Ryan Automatic Navigator Guides Global Flight

An advanced system of aerial navigation, designed for high-speed, long-range flight, has been developed by Ryan electronics engineers, working under sponsorship of the Navy's Bureau of Aeronautics.

Designated AN/APN-67, the new navigator is the lightest, most compact, self-contained electronic navigator in production. Developed to meet military needs, it will also meet commercial jet flight requirements.

The system provides pilots and navigators with continuous information on altitude, ground speed, ground distance, drift angle and ground track. It is sensitive and instantaneous. Keyways to computation, ground location or wind data.



AUTOMATIC NAVIGATOR guides pilot with single instrument (above).

Ryan Jet Investments Create Opportunities for Engineers

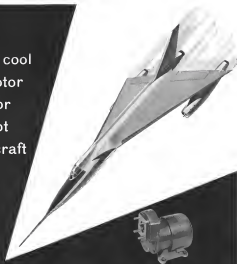
Now in the future, Ryan Jet Engine, which has the new jet engine, is a major step in the development of a new jet engine. It is a major step in the development of a new jet engine. It is a major step in the development of a new jet engine.

Ryan Jet Engine is a major step in the development of a new jet engine. It is a major step in the development of a new jet engine. It is a major step in the development of a new jet engine.

RYAN ENGINEER "probes" VTOL up-to-date possible cockpit.

RYAN ENGINEER "probes" VTOL up-to-date possible cockpit.

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aircraft



Unique construction of Westinghouse gearhead motor assures maximum horsepower...even at high temperatures

Westinghouse aircraft gearhead motor meets requirements of 2000, 3000-PSHA. Fully enclosed, fire proof, oil-torque-proof. Capable duty ratings of 30 to 250 hp available within speed ranges 1200-3000 rpm. Higher ratings available for intermittent duty.

Faster—Higher—HOTTER!

Today's aircraft demand electric motors that can operate in ambient air above normal—at no sacrifice in efficiency.

The lightweight Westinghouse electric gearhead motor meets this challenge. The unique forced blower provides an extra-large flow for dispersal of internal motor heat. An external fan and shroud channels air over the fan, driving off the heat quickly, efficiently. The rotor design itself provides an efficient internal circulation of air without the added weight of a separate external fan.

Result—the Westinghouse motor operates at a maximum horsepower-to-weight ratio regardless of surrounding temperatures.

Westinghouse engineers draw on 40 years of experience for specialized solutions to aircraft electrical problems. Why not take advantage of this experience by using our planning boards for your electrical needs?

4-10-55

YOU CAN BE SURE...if it's Westinghouse

AIRCRAFT EQUIPMENT DEPARTMENT, LIMA, OHIO



Lander based in the course of the Navaho studies that measurements at this distance as determined by range plane comparison, were much more precise than measurements of bearing. But this means the post calibration report issued at Reno proposes a three-to-one ratio of Navaho.

In discussing the results of the more extensive tests, the report states: "This method of measuring distance can easily provide an accuracy of ± 5 m. to 1,000 m. and beyond when utilizing 100 Ls. transmitters."

Project Officer for Navaho, Maj. Eldred L. Nicholson, assistant chief of the Control Laboratory at the Reno Center told AVIATION WEEK that with further development in airborne computers and improved transmitter power the three-to-one ratio of Navaho is capable of meeting the most stringent requirements of Air Commanding General's Document 18-91.

A second advantage to Navaho (he pointed out) is the rubidium report is that this data is readily convertible into radio-frequency coordinates for use with dual receiving and auto-navigation computers. Samples of this conversion comes from the fact that, with the length of three sides of a spherical triangle known, values can be in the line of course.

Operational difficulties are anticipated in the possible implementation of other centers of Navaho requiring an airborne precision frequency standard.

Currently available crystal standards require long warm-up periods prior to stabilization in order to be provided with an uninterrupted source of power. Reno's evaluation report covers a storage area and power source at each

base, or support where Navaho equipped aircraft will be based to keep the crystal standards in operating order between flights. The frequency standard would be checked and checked in the aircraft immediately prior to a flight. Such overall frequency standards are presently available.

An alternative to the crystal standard in the so-called atomic clock that is presently under development (Oct. 22 1955 p. 1011). However, it appears that for the present at least they will be both keen and expensive.

Expansions, Changes In Avionics Industry

Industrial Electronics Inc., Norwalk, Conn., is a new, multi-faceted company which will develop and manufacture various avionics and instruments. The firm is headed by R. Douglas Redden, president, and Norman C. Anderson, vice president, both formerly with Electronic Corporation of America. New firm's address: 165 Highland Ave.

Other recently announced avionics industry expansions and changes include:

• **Hoffman Laboratories, Inc.**, Los Angeles formed an Avionics Division department to develop and manufacture sensor systems, gyro, inertial platforms and other precision electro-mechanical devices. Lawrence Wiedel has been named vice president in charge of new department to be located at 1621 South Elgin St., near Hollywood in Los Angeles.

• **Electronetics Corp.**, North Hollywood, Calif. will build 10,000 sq. ft. aircraft plant at Compton Park, Calif.



Tap Typewriter Aids Datamation

Electronic punched tape typewriter made by Remington Rand transfers typed data into punched tape for subsequent computer processing or when fed punched tape prepared by it in other machines, automatically adds and drops out the information at 333 words per minute.

Over 92% of the torque wrenches used in industry are

Sturtevant TORQUE WRENCHES

Start by light, hand or foot

- Permanently Accurate
- Practically Indestructible
- Faster—Easier to use
- Automatic Release
- All Capacities

In tool rooms...job boxes...job posts...test benches...1000 sizes from 5-4000 ft. lbs.

Large inventory of standard and special sizes...all types...all capacities...all brands...all makes...all prices...

Sturtevant
1000 W. 10th St., Chicago, Ill.

Performance

proved in flight

More light planes are equipped with Sencenich Propellers than any other make.

TESTED BY THE U.S. AIR FORCE
CAR reported up to 50 hp
STANDARD PITCH WING CAR turned up to 100 hp

TEST CURVES
up to 1000 ft.
Show the Difference and Price Value

Dept. R, Sencenich Corp., Lancaster, Pa.
Sencenich 1957 Model...also the Sencenich 1958 Model...also the Sencenich 1959 Model...also the Sencenich 1960 Model...also the Sencenich 1961 Model...also the Sencenich 1962 Model...also the Sencenich 1963 Model...also the Sencenich 1964 Model...also the Sencenich 1965 Model...also the Sencenich 1966 Model...also the Sencenich 1967 Model...also the Sencenich 1968 Model...also the Sencenich 1969 Model...also the Sencenich 1970 Model...also the Sencenich 1971 Model...also the Sencenich 1972 Model...also the Sencenich 1973 Model...also the Sencenich 1974 Model...also the Sencenich 1975 Model...also the Sencenich 1976 Model...also the Sencenich 1977 Model...also the Sencenich 1978 Model...also the Sencenich 1979 Model...also the Sencenich 1980 Model...also the Sencenich 1981 Model...also the Sencenich 1982 Model...also the Sencenich 1983 Model...also the Sencenich 1984 Model...also the Sencenich 1985 Model...also the Sencenich 1986 Model...also the Sencenich 1987 Model...also the 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Traveling Wave Tube Offers Weight Saving

Pasadena, N. J.—Significant weight saving in airborne electronic communications and radar equipment may result from new tube traveling tube, developed by Radio Corporation of America. New tube uses electrostatic focusing to eliminate 5 to 30 lb. of external focusing magnet previously required.

Experimental Shrad traveling wave tube, developed by Dr. K. N. N. Chang, weighs only 1 lb. complete, compared to about 20 lb. for a comparable tube, with magnetic focusing. New technique can be applied to tubes for a wide range of microwave frequencies. Dr. Chang told Aviation Week, "It being limited only by mechanical fabrication problems. For extremely high frequencies, the new tube may prove more difficult to manufacture than a conventional design, but at such frequencies magnet weight is relatively low."

RCA selects electrostatic focusing by using two pairs of spiral windings, one pair surrounding the electron beam in a conventional design; the other inside the hollow electron beam. The two pairs in combination provide focusing while the outer pair carries the radio frequency signal being amplified. Others have constructed traveling

wave tubes with electrostatic focusing. However, RCA has told that RCA is probably the first to use a pair of spiral windings inside the electron beam. RCA's electrostatic focusing technique does not sacrifice any of the desirable characteristics of magnetically focused tubes and can provide slightly more gain. Dr. Chang said.

Built-in electrostatic focusing diminishes the problem of slugging the tube relative to magnet during installation in field replacement, an important advantage, according to RCA. It also eliminates possibility of magnet becoming misaligned during use as result of shock and vibration.

New tube is moving from laboratory into development stage and RCA does not indicate when pilot quantities might be available.

FILTER CENTER

• Radar Beams Tests Soon—Civil Aeronautics Administration's service evaluation of air traffic control beacon system is scheduled to start within 30 days in New York area. Number of air beams being into New York area will be equipped with transponders for the evaluation.

• Automation for CF-105—CF-105 will be equipped with Messerschmitt-Bölkow-Blohm (MBB) computer which will enable radar for control action to directly guide airplane to the target, operating through an MBB computer. Computer signal handling processor is included to prevent fire control system from cutting for dangerous maneuvers.

• Signed on Dotted Line—Major contract awards recently announced by several aerospace companies include:

• Eikon, Inc., Boston, will build data processing equipment for General Electric's Visual and Guidance Systems Department. Equipment will be used to process missile test data preparation to computer in a digital computer.

• Avco-Cordell reports three new contracts totaling \$11.4 million. One, for \$6.6 million from Air Materiel Command, is for three improved Vulcan traffic control computers. The other two are for \$5.6 million from Intercontinental Business Machines Corp. and one for \$8.2 million from Harbord cover equipment for use in SAC's air defense system.

• Perkin-Elmer Electronics Corp. has received firm contract to develop high speed digital computer for use in Redstone Arsenal's computation center.

• Radio Corporation of America reports \$750,000 order from Sandia Air Force Station for AN-10 radar for use in the SAS fleet of DG-7C's.

40% lighter*... a man can carry it in one hand
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SAFETY

CAB Accident Investigation Report:

Single Engine Approach Made Too Fast

At 1500^h November 15, 1985, Twin World Airlines Flight 105, a Martin 404, crashed at McCarran Field, Las Vegas, Nevada. The accident occurred during an attempted single engine go-around. The engine and fuselage and 14 of the 16 passengers received minor injuries. There was no fire, however, the aircraft was damaged beyond repair.

HISTORY

Twin World Airlines Flight 105 is a regularly scheduled domestic operation between Kansas City, Missouri, and Las Vegas, California, with intermediate stops at Tampa and Wichita, Kansas, Albuquerque, Texas, Santa Fe and Albuquerque, New Mexico, and Las Vegas, Nevada. A scheduled crew change is made at Albuquerque. Thus, on November 15, 1985, Captain Milton G. DeFoley, First Officer James P. Baggett, and Flight Attendant J. Zentgraf boarded Flight 105 at its origin to complete the remaining approach. The flight was enroute to Las Vegas where it landed at 1440.

During the short ground time at Las Vegas the aircraft was serviced and the crew performed routine duties for maintenance of the flight to Las Vegas. There was no apparent need for maintenance on the aircraft and none was performed.

An instrument flight rules flight plan was prepared and filed because of instrument weather conditions over the route.

portion of the flight approach to Las Vegas. Weather conditions at Las Vegas became very clear.

At 1449 Captain DeFoley, seated in the captain's position, taxied N 40404 from the Las Vegas terminal to ramp position heads-on to 7 where the required go-around checklist was accomplished. The aircraft and approach expanded smoothly. The flight was cleared to instrument climb over the Las Vegas traffic control.

At the time according to the passenger load manifest the gross weight of the aircraft was 41,001 pounds, well under the maximum allowable for takeoff 41,500 pounds. The load was properly distributed with respect to the center of gravity limits of the aircraft.

Engine Feels

With Captain DeFoley operating the aircraft, Flight 105 took off at 1450. The takeoff was routine and was followed by a climbing left turn to gain altitude and establish a southwesterly track toward Las Vegas. At 1501, when just the northern perimeter of the city, First Officer Baggett advised the Las Vegas tower stating the flight was returning to the airport, on one engine.

The Las Vegas tower controller an aircraft method of other traffic to remain clear and cleared emergency equipment. Flight 105 was cleared to land on runway 14 and advised that the wind was calm. Captain DeFoley continued to one runway. "and First Officer Baggett advised the tower emergency equipment was then dispatched

into position on the runway parallel to Runway 14.

N 40404 was soon cleared on a wide base leg for Runway 14. It turned onto the final approach position and altitude of the flight seemed normal. As the aircraft came down its extended gear could be seen and in left position was clearly visible, stopped and lowered.

At the runway point, with the aircraft held on the approach position and altitude, several good decisions to make all minutes remained, speed was apparent. The aircraft showed a considerable distance down the runway before landing. It then bounced several times after which an application of power was found, although it was attempt to go around.

The Martin climbed, veered to the left and in left wing gradually lowered. It seemed to "struggle" to continue flight and an engine decreased rapidly. Seconds later the runway struck the ground left wing lost, just inside the airport boundary.

Weather conditions at the time of the accident were clear, visibility 65 miles and the wind was calm. A large cloud of dust cloud by the accident, hung over the scene and gradually lifted nearly vertically in confusion of the cabin crew.

INVESTIGATION

One witness who was operating as passenger vehicle on the runway parallel to Runway 14 when the accident occurred, reached the scene within 10 to 15 seconds and that passengers began to evacuate the aircraft approximately 10 seconds after



TWA MARTIN 404 after settling into the ground during single-engine go-around at McCarran Field, Las Vegas, Nov.



"Bernie" Fenwick, outside Friendship International Airport's Terminal Building. Directly behind him is a Convair plane operated by Eastern Airline, one of Pan-Maryland's airline customers.

"There's no ceiling on success when you fly with Shell!"

says G. B. Fenwick, Jr., President of Pan-Maryland Airways. P-M boosted its gallonage fiftyfold in six years as a Shell Aviation Dealer at Friendship International Airport, Baltimore

It's no wonder Bernie Fenwick is happy Pan-Maryland teamed up with Shell in April 1961. At that time, one truck was more than enough to handle their business. Three months later, thanks to Shell's help, they began making in-stoppage deliveries to the airlines.

Today, Pan-Maryland has 13 trucks busy fueling and servicing the airlines, private airplanes, jet fighters of the National Guard, police department aircraft, helicopters, military

and government-owned aircraft and dozens of corporate aircraft.

"We've got an extremely diversified operation here," says Bernie. "Pan-Maryland handles everything from Cubs to F4D Navy jets—from Miles to B-52s."

"Consequently, we handle the complete line of Shell Aviation Fuels, including Shell Turbine Fuels for jet planes and commercial turboprop airplanes.

"Shell also provides us with a full line of AeroShell lubricants, fluids and greases to fit our customers' needs. What's more, we get up-to-date technical advice from our Shell representative who's always at our service."

When Bernie talks about the services Pan-Maryland gives its customers, he emphasizes that delays are almost nonexistent. All pilots have schedules to meet and what they want most of all is fast, efficient, on-schedule service.

A "Customer's Service Report" is mailed to every flier who stops at the field. It invites comments and criticism of service, workmanship and courtesy. Replies like "Best service I've ever gotten—anywhere," "Excellent in every way," "Keep up the good work," are received every week from all over the country.

Bernie points out that their CAA Certified Repair Station is going to be finer than ever. A big new hangar will be completed soon and he plans a Class 4 shop there, with service crews qualified to work on every type of plane.

Other plans for the future include branching out into airline ramp service, setting up an aircraft sales department, building more hangars and boosting gallonage still further.

"After all," says Bernie Fenwick, "the sky's the limit with Shell."



Private planes get fast, efficient service. Every civilian pilot who uses the field receives a "Customer's Service Report" which requests suggestions for improving service.



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Cubana Orders 707s

Managers of Compañía Cubana de Aviación are drawn to Boeing 707, two of which have been ordered by the airline. Model chosen was 707-123B. Aviation Week last reported (April 1, p. 48) that Cubana would order the 707s and also two Boeing 747s.

has arrived and that all the components were not in less than two months.

Nearly all concerned with the investigation were certain that it was caused and under competent direction and supervision of the crew members, using the forward loading door and emergency window exits.

Casualties showed that the left wing tip of the aircraft made the initial contact with the ground and that it was followed closely by the left engine nacelle and its cabin fuselage. The aircraft then slid on its belly in an upright position for 275 feet along a southeast heading. While sliding, the aircraft turned left around its vertical axis so that when it stopped the aircraft was headed northeast. The final resting place was located about 980 feet north of the centerline of Runway 7 measured from a point 200 feet west of the end of it. The aircraft's Aeroflot elevation is 1,371 feet above sea level.

Aircraft Damage

The aircraft received considerable damage from the ground impacts and the subsequent sliding forces. The fuselage was severely damaged, particularly in the area of passenger seats. Elsewhere it was twisted and buckled. The wings were severely damaged. Both wings of the aircraft were buckled and the right wing was broken clockwise just outboard of its engine nacelle.

The left engine was found turned out about 40 degrees to the left which bent and broke its engine mounts. The right engine was torn out during initial forces and as the aircraft slid forward in the ground the engine was rolled around several times. It then struck and penetrated the right side of the fuselage floor. This seat was found tipped in the cabin floor just ahead of passenger seat No. 2.

The main and nose components of the landing gear were found badly distorted. The wing fuel tank was found in a slightly deformed position. However, examination of the fuel tank indicated that it would have allowed the fuel to move from the position which caused it the extent of its path.

The engines and propellers were removed from the aircraft and shipped under government seal to the company's maintenance facilities at Krome City. There, under the direction of a Boeing engine specialist, the components were carefully examined.

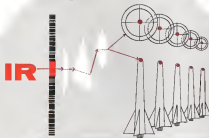
The left engine was torn down to determine the reason for its failure. All major bearing covers were removed and the initial areas checked for clearance. The No. 2 cylinder exhaust valve rocker arm was found to have excessive clearance. Its push rod was then removed and examined. The ball end of the push rod was found to be bent and the space between the push rod and the ball end was broken into several pieces and completely displaced. The end of the push rod was intact, with pieces broken away. The ball end and rocker arm were bent out and polished.

Engineers collected evidence that the push rod failure occurred where the ball end was bent and the push rod was bent.

Now a replacement push rod was installed during engine overhaul. Before the ball end and roller are purchased separately whether new or remanufactured, the ball end was pre-tested to the roller in a TVA over test operation. Examination of both propellers and the right engine disclosed no evidence that they were in other than good condition prior to impact. Engineers indicated this engine was capable of delivering its specified power. Further there was no fault with respect to the maintenance practices (MUT) system.

Company maintenance records showed the aircraft and its components had been maintained according to company procedures.

There was no record of any flight push rod failure on TWA's Martin aircraft prior to the subject incident. The investigation of this accident included an examination and bench check of the same components of the hydraulic system. The parts were removed from the aircraft and the work was done under



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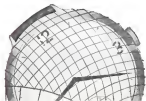
As a matter of fact, Switzerland is America's best cash customer in Europe. A customer who has spent in America every dollar she has earned in America since 1948—plus 50% more! American business has gained a fat, favorable trade balance of \$560,000,000!

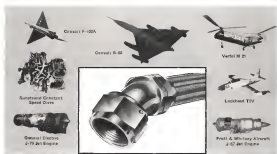
The present volume of trade between Switzerland and America took off with the reciprocal trade agreements of 1956 between our two democracies. It would be a pity for both of us if we couldn't keep it up.

In 1954, America hiked the tariff on jeweled-lever Swiss watch imports by a huge 50%. Since then, further restrictions are being considered. And they could price the Swiss watch right off the wrists of Americans!

But the reciprocal trade between Swiss and Americans has gone on for a long time. It was brought about by men of good will and good business. Surely, today's men of good will and good business will want to prevent a forced landing now.

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While today 300 test flights a single engine approach the aircraft is committed to a landing. Training personnel said that although a locked landing procedure was in preparation it had not yet been made a part of the T-28 World Flight Open House Manual.

A company spokesman said that perhaps the company pilot training had not stressed the single engine landing procedure enough prior to the Los Angeles airshow. He added that the company probably began the program intended to teach the pilots to make the single engine approach and landing without assistance.

He stated the performance and ability was expected of a test captain and that in all of the maneuvers he had given in the Martin 404 was a record of several years he had never seen an accident on a single engine approach.

ANALYSIS

Examination of the No. 2 cylinder exhaust valve pin and showed conclusively that the failure of the seal was the cause of the left engine failure which occurred shortly after takeoff. The examination further showed the failure occurred when the ball end of the pin struck the end of the valve seat. This was the result of an improper fit made in the T-28 World Flight department.

This failure caused the exhaust valve to remain closed thereby trapping exhaust gases under pressure which could not be discharged through the exhaust port. Therefore, when the intake valve opened these exhaust gases entered the



SAS Signs for Caravelles

Bombardier Aviation Systems president William Thomas (left), center, and Sud Aviation president Georges Harel (right) sign contract for SAS Caravelles. The Bombardier contract has ordered 6 of the French transport aircraft from SAS. Delivery of the first aircraft is expected in 1969.

Induction system of the engine causing loss of power, buckling and engine stoppage.

The final is of the engine that the engine would be of such severity that the pilots in the engine would be expected to take the engine out of operation by backing up the propeller. It is expected that therefore the pilots operated the aircraft under the stress and demands of an emergency situation. Under this situation the aircraft was launched propeller during the descent leg and until the flight

was backing up the propeller. It is expected that therefore the pilots operated the aircraft under the stress and demands of an emergency situation. Under this situation the aircraft was launched propeller during the descent leg and until the flight

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gear and hydraulic systems, or the ADI system.

The board determines that the probable cause of the accident was the design of the emergency shutdown system. It failed to return speed during the latter portion of a single engine approach; this excessive speed resulted in an overshoot and an attempted go-around which was beyond the performance capability of the aircraft under existing conditions.

By the Civil Aeronautics Board
James R. Dwyer
Chairman
Norman D. Dean
C. Joseph Martin
(Member Louis J. Baker did not take part in the adoption of the report.)

SUPPLEMENTAL DATA

The Civil Aeronautics Board has notified of this accident at approximately 1600 November 15, 1976. As investigations are immediately initiated in accordance with the provisions of Section 701 (a) (2) of the Civil Aeronautics Act of 1958, as amended.

Departments were held at Las Vegas, Nevada, on January 17, 1977. Santa Monica, California, on January 21, 1977, and Kansas City, Missouri, on January 23, 1977.

Trans World Airlines has a Delaware corporation is a subsidiary of parent with its principal offices at Kansas City, Missouri. It operates a scheduled airline service of public convenience and safety under the Civil Aeronautics Act of 1958, as amended.

This certificate authorizes the carrier to transport by air persons, property, and mail under various routes including the route described. Captain Arthur G. DeFuria, age 49, held a currently effective annual certificate with airline transport rating and an appropriate rating for the Boeing 747-400. Captain DeFuria was employed by TWA April 24, 1977. He had a total of 9,411.54 flying hours, of which 415 were in the type equipment as required. His last physical examination was on September 24, 1976. His last medical check was on October 16, 1976.

First Officer James F. Rappaport, age 31, held a currently effective airline certificate with commercial rating. He was employed by TWA on May 26, 1977. He had a total of 9,020.40 flying hours, of which 1,051.32 were in the type equipment as required. His last physical examination was on October 16, 1976. His last medical check was on October 5, 1976.

Flight Attendant J. Green was employed by the company August 29, 1976. The grade held from October 1976 to September 23, 1976. His last scheduled emergency evacuation practice was on September 21, 1976.

N 46484, a Martin 404, manufacturer's serial number 11191, was manufactured in 1975. It had a total of 10,415.95 hours of which 1,051.32 had been flown but had been overhauled. It had accumulated 76-24 hours since its last 75-hour inspection. The last action report and line maintenance check was accomplished November 15, 1976, at Kansas City, Missouri.

The aircraft was equipped with Pratt and Whitney R1500C16 engines and Hamilton Standard propellers model 480849. The aircraft was certified by the Civil Aeronautics Administration.

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Action to take: If you desire additional information, use the coupon in request "A Decade of Research," a 68 page report on the Laboratory's research progress over the past 10 years. If you are interested in employment at C.A.L., check the box below for additional information. All inquiries will be treated as confidential.

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LETTERS

Industry Perspective

To our frequently belated editors of *Space Shuttle News*, I'd like to say thank you for your editorial "Where Do We Stand?" in very mid-July. It is about time until most people have seen in print the perspective on the Shuttle and the perspective of our support. I hope *Aerospace Week* sends such messages as that to additional visitors across the country.

Walter Plorenz

Vice President

Public Relations

Air Transport Association of America

Washington, D.C.

'Excellent Report'

I have just read your excellent report on the shift to intensive constant speed drive in the B-52 (AW July 24, p. 11). Of course, we are particularly grateful for your inclusion of Vietnam as a supplier of constant speed drives.

It's reporting jobs such as this one that keep *Aerospace Week* on my "must for reading" list. I am in key up with what is going on in this hot money industry.

My friends agree to the editorial job for the last weekly job you do and I'm sure it will help you have more in the past.

R. W. Bussacchi

General Manager

Victory, Inc.

Detroit, Mich.

GE's Reaction

This is just to comment on the article in *Sub-Carriers* in the June 24 issue of *Aerospace Week*. The article is well written and is in *ES* (p. 50).

We feel that *Aerospace Week* has done an excellent job in covering the complex situation involved in the B-52 program. We appreciate the difficulty of interpreting the technical aspects, constant load power, design and control issues, which we are the principal components of such a move and believe that *Sub-Carriers* has presented a picture in the clear and precise way.

Paul Sauerbrunn

Manager, Product Information

General Electric

Lowell, Mass.

Chinese Sabres

I wish to say you are "Solid as the Rock" (AW July 15). It was a fact to note that the only air force other than the USAF which had the Sabres in combat were the Chinese.

The (Nationalist) Chinese Air Force reported, under the name of Sabres, that a comparatively later date but very able.

Aerospace Week welcomes the editors of its readers on the news and on the subject's editorial columns. Address: Letters to the Editor, *Aerospace Week*, 500 E. 42 St., New York, N.Y. 10017. To have letters in the 500 words and give a personal identification. We will not print anonymous letters, but names of writers will be withheld on request.

To publish good record of both pilot and pilot after a short period of training.

The pilot, and the many others in the first few 500 on into more training and service of M-4 and three land. One confidence in the aircraft might have been as a lot less but the planes brought in back.

As to the Chinese Communist pilots, we feel generally sorry for them. As to the Korean war, most of the Chinese Communist pilots were turned out of the air.

Edwin (Hongkong) is in the air with a friend in the Communist.

May all others who be kept.

Kenneth C. Smith, Jr.

Sub-Editor for Air Force

Chinese Government Personnel

Air Force

Washington, D.C.

Italian Team

I have just received on June 17 issue of *Aerospace Week* and was delighted to see your picture of the Italian Air Force. From building to light formation (the line position and comments in p. 11).

One of the Air Force Section of MAAG has been left for some time that the Italian Air Force was among the best. Now we are told that we were not too involved.

Generalissimo, Massimo J. Amos USAF

Chief

United States Air Force Section

Ministry of Defense, Air Force Group

Ministry of the United States of America

Air Force

New York, N.Y.

Subsonic First

I am deeply touched by the concern of *Aerospace Week* and issue of its readers over the subject of supersonic wind tunnels (AW July 8, p. 154). Having covered the design of supersonic facilities as well as the (apparently) overlooked in the subsonic wind tunnels, their interest is appreciated.

However, the letter is not ready to read the virtues of the supersonic, but to point out that every aircraft, even those in development, and every pilot that attempt and extend the velocity of record must, both before and after the representative job take place through the "supersonic" tunnel at the subsonic.

Having taken to the subsonic air can say that to the day new subsonic wind tunnels are being constructed, not only for sustenance of higher testing but

to sustain performance and stable standards. There is no fact that these subsonic wind tunnels are not in the air, and in the profile of the NACA. And in this group, a growing reliance on subsonic wind tunnels for the control subsonic load, as well as R & D work for RLC in development, side itself with leading edge VTOL and critical loading problems, such as structural reliability, test equipment, personnel and pilot safety problems, handling dynamics, no accident but a lot of the between of a previous decade (which we have in subsonic), and we see the more intensive monitor is due the considerable subsonic test trend.

To emphasize the point of a previous contribution to our readers, apparently only our contractors have that we design and construct wind tunnels.

W. M. Sivakov,

President,

West Coast Research Corp.

Los Angeles, Calif.

We Did

Wow! If for you could it be that?

Re *Aerospace Week* (June 21, p. 14 and July 8, p. 15).

The article depicted in our lives was as a PVT, which hardly was known as a PVT 2 (pilot).

James E. Frazier

Assistant Head,

Flight Test Division

Naval Air Test Center

Pensacola, Fla.

... But He's Content

In spite of "Dignified Exponent" about his own single time as being a pilot (AW July 8, p. 154) I should like to go, how the results of a little survey we took in our own office.

The two first comments from the survey was that he likes to see off. That 50%, for "Solid ground" doesn't do us as much as 40-45% at least 10% here, and then I think, and we have "contentment" that 50% in the opposite end is also very content in subsonic. Our survey shows that the response in our office (and best 20%), of those time when going in characterizing the job. That 50% has been very happy, and a little, and then that when all the time we have during the working hours, which focus us all in time as to work in the company to get our work done.

Now, since we all have to come in at night like we just don't have any subsonic working "on nights when the bus is going to be here" because we're all there. I work long hours, but I'm certainly not content.

Comments: Exponent

Alton, Ohio



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Keeping pace with the development of modern, high-performance fighter aircraft, Wright Air Development Center has created a whole new concept in instrumentation.

Old fashioned clock-type dials which take time to read and interpret, and which waste valuable space, are being replaced by what WADC calls "whole panel instrumentation." This concept presents flight information in a relatively few, integrated displays in directly usable form, saving time and space. And, it is now possible to place command information before the

pilot, showing him what he should be doing and how to do it.

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